GAS JOURNAL

LIGHT ⁘ HEAT ⁘ POWER ⁘ BYE-PRODUCTS

(Founded in 1849 as the "Journal of Gas Lighting.")

PROPRIETORS: WALTER KING, LIMITED. OFFICE 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

Telephone: Central 6055. —— Telegrams: "GASKING, FLEET, LONDON."

VOL. CLXXX, No. 3366] WEDNESDAY, NOVEMBER 23 1927 [79TH YEAR.

Editorial Notes.

Partial Drying of Town Gas—An Important Development.

THE avenues open to the research worker in gas distribution but a few years ago would have appeared small indeed. It was accepted as inevitable that gas left the works saturated with water vapour, and that means must of necessity be provided for removing on the district such proportion of the moisture as condensed out due to a fall in temperature in the mains and services. It was also accepted as unavoidable under certain conditions that occasional obstruction in, and deterioration of, services, meters, and fittings should occur. The extended application, however, of gas for heating for a multitude of domestic and industrial purposes, all embodying forms of burners designed to effect complete combustion, with fine adjustments for gas and air regulation, has brought with it recognition of the importance of giving the consumer a regular and uninterrupted supply of gas at full pressure. The presence in the mains, services, or meters of any obstruction, either solid or liquid, is now generally recognized as being inimical to the securing of maximum gas sales, and a potent cause of permanent loss of consumption. Such recognition has resulted in the widespread adoption at the works of means for removing naphthalene from the gas. There still, however, remains the problem of interruption of supply by deposited water, and the still more serious corrosion due to the presence of oxygen in the gas and the various compounds in solution which are destructive to steel and iron.

The paper which Mr. C. Harris, of Taunton, read before the Southern Association of Gas Engineers and Managers, last Wednesday, marks an important conversion from crude to scientific practice in dealing with moisture in gas. It described a practical and, as far as can be ascertained at this juncture, a successful solution of the problem. As the President (Mr. Thomas Hardie) remarked, the contribution gives complete and thorough information respecting the process; and there is no doubt that this thoroughness will do much to bring the system into great prominence and adoption. It is the outcome of patient and careful research, which, in many ways, breaks entirely new ground; and much credit is due to the inventors (Messrs. C. Cooper and D. M. Henshaw) and the members of Messrs. W. C. Holmes & Co.'s research staff, who are responsible for the investigations and the design of the plant. Incidentally it may be mentioned that the application for the first patent is dated December, 1924; and it is evident from the wide field of the patents covering the process that a considerable amount of research and experiment has had to be accomplished before arriving at the stage of development as represented by the working-scale plant now existing. This is further indicated by the detail in the graphs and tables attached to Mr. Harris's paper, much of which is of an original character.

The paper is excellent in design and clearness at this initial stage of the discussion of the problem of the partial dehydration of gas. It introduces the fundamental considerations which constitute the case for the application of a process. It discusses possible methods. But it is the Holmes "Dri-Gas" process that Mr. Harris and other engineers have adopted; and therefore it is upon this system, its effects, and its costs (which must be considered in relation to the expenditure and to the difficulties it obviates) that there will be concentration by the technical mind. In the process a concentrated solution of calcium chloride is employed—the degree of drying which can be accomplished by such a solution being, of course, dependent on the vapour pressure, which varies according to the concentration and the temperature. At Taunton, a Holmes patent rotary brush scrubber-washer is used—the first six chambers being supplied with the calcium chloride solution; and the second six with gas oil for naphthalene extraction. Probably it is largely owing to the gas, and therefore the gas oil and brushes, being free from moisture that practically complete elimination of the naphthalene is obtained—at any rate, below 1 grain per 100 c.ft., using only 14 gallons of oil per million c.ft. of gas treated. Provided the temperature of the calcium chloride solution is kept down to the temperature of the incoming gas, the dewpoint of the latter can be reduced by 25° to 35° Fahr., according as the initial temperature varies (say) from 50° to 80° Fahr. A large amount of information regarding the results is given in the tables at the end of the paper, including data as to the increase in the dewpoint in the passage of gas through the holder. A film of oil of about $\frac{1}{16}$ in. thick is maintained on the surface of the water in the holder, and also on the surface of that in the cups. There is a slight re-absorption of moisture in the holder; but this has not increased the dewpoint by more than 2° or 3° Fahr. in winter or more than 5° in summer.

The practical effects are proved; the cost is another point. It will be closely examined. The direct costs are established; the resulting monetary savings are not so easily calculable. But they are there. The direct costs diminish with the size of the plant, or rather the work to be done; and in this regard readers will study both Mr. Harris's figures and those supplied by Mr. T. Carmichael, of Portsmouth, in the discussion. Mr. Harris gives his charges at Taunton on the basis of the dehydration of 1 million c.ft. of gas per day; and they work out (the constituent items are given in the paper) to 19s. 3d., or 0·231d. per 1000 c.ft. He mentions that they would be lower on a larger plant—0·15d. per 1000 c.ft. on one treating 5 million c.ft. per day. Mr. Carmichael deals with 6 million c.ft. per day, the capital cost of the plant for which was only half that of the Taunton plant per million c.ft. per day. His working expenditure is about

half that at Taunton—9s. 6d. per million c.ft., or only 0·026d. per therm. We think these figures and the considerations regarding advantages are, at any rate, a *primâ facie* answer to those gas suppliers who argue that they cannot afford further complications in, or additions to, works plant in these days of keen competition and dear capital. It is not a case for short-sightedness. The menace alone to good relationships with the consumers prompts the question as to whether we can afford not to adopt a process which gives reasonable promise of safeguarding them from an interruption of supply. We know, too, that corrosive action on the metal work of gas distribution and storage plant has been intensified since modern manufacturing methods have almost denuded gas of those oily constituents which it formerly possessed. However, we learn that the plant is being installed by a number of undertakings for quite a variety of reasons connected with distribution troubles; and gas engineers generally will await the results with considerable interest. There will arise the point as to whether the drier gas will produce any temporary contra effects, particularly in mains with internal surfaces already corroded, and, with the increase of pressures, gas passing through them at higher velocity, and carrying forward fine dust. But experience so far does not suggest that this is occurring.

There is the question of revenue loss, to which the President referred, by the reduction of the volume of gas by 1 to 2 p.ct., with an increase in calorific value. The official test requires gas to be saturated with moisture at 60° Fahr.; so that, if gas is supplied free of moisture, there will be a loss. The National Gas Council are taking up this matter with the Board of Trade; and it is hoped it will be adjusted. At the same time, Mr. Hardie does not suggest there would be an actual net loss to the extent of 1 or 2 p.ct., seeing that the advantages might conceivably more than counterbalance the loss. Mr. Carmichael, on the other hand, manifestly does not see much in the point, inasmuch as, before the adoption of the "Dri-Gas" process the moisture in the gas was largely condensed out in the distribution system, and this involved costs which would be avoided by use of the process.

Attention has frequently been drawn to the value of co-operation between the trained engineer and the chemist and physicist in securing improvement in the design and operation of works processes; and here we have an encouraging illustration in a new field of what can be achieved by such means. Both the inventors and Mr. Harris are deserving of congratulation. Reminder is given by Mr. Harris that, since this research work was first undertaken, similar investigations have been carried out on the Continent at Zurich and in America, which confirm the conclusions which have been arrived at here. It is gratifying that this country should be the first in the field with a practical solution of this important problem.

Romance of the Gasholder.

It is an excellent plan for the Chairman of the Council of the Society of British Gas Industries to deal in his address with the subject with which his business life is mainly identified. The membership of the Society is composed of all the different plant and apparatus branches of manufacture which are essentials to the provision, distribution, and utilization of the primary product, and to the handling and working-up of the secondary ones. It is a proper thing that those who are specialists in one component of the industry should know something of the work of the other ones. It engenders greater mutual interest. Mr. R. B. Hodgson, the present Chairman of Council, was correct in his view that an address on gasholders, with the building of which he is associated, would be of interest, and not without instruction, to those of his fellow-members who have little to do with structures so highly important to the well-being of the industry, and to the protection of the communities it serves with gas. He titled his address, which was delivered last Thursday: "The Romance of the Gasholder." We are not going to question the use of the word "romance," which, as he says, has "wide and various applications." But we usually think of fiction, or of something vague and maybe tender, when we talk of romance. There is nothing fictitious, vague, or tender about a gasholder. It is a very material entity. If there is anything approaching romance about it, it is to be found in the history of its development; and it is from that angle that Mr. Hodgson so interestingly and concisely treated of his subject.

Everybody in the gas industry ought to be grateful to the gasholder. It may look a cumbrous thing to some people, and a doubtful subscriber to the beauties of the landscape; though here again there are engineers whose idea of the beautiful is circumscribed by the details of an engineering structure. But of what the gasholder has done for the industry in contributing to the economy and efficiency of gas manufacture, in balancing output and demand, in enabling the community to draw upon the gas-mains at will, in meeting peak loads, and in acting as a bulwark to our service, we all know, but cannot assess the value in actual money. It is grudging credit that we thoughtlessly give to the indispensable holder, because its activity is not so obvious as, say, that of the carbonizing plant or a piece of moving machinery. It does its duty in a regular and staid manner, and without giving much trouble, although the older types have of late, in respect of erratic pressure behaviour, been the subject of a little mild abuse in lauding the claims of the latest comer into the storage field. But the old types have done well for us; and they are not an unimportant item in the superior equipment of the gas industry compared with its chief competitor.

However, we agree with Mr. Hodgson that the history of the gasholder makes a fascinating story. Who can look back at the small beginnings, and trace step by step the development from a bladder to holders of 15 million c.ft capacity, without finding it so? Who can think, without feeling admiration, of the engineers whose talent, enterprise, and courage led to the progress to mighty sizes and money economy per unit of capacity? Had holders remained even as they were sixty or seventy years ago, they would have been an extraordinarily costly item for the industry, having regard to the development in the demand for gas. The size of holders typify as well as anything the business expansion of the industry, despite the power of the ever-ready water-gas plant to meet sudden flights in gas requirement, and the contribution of the day load to the levelling-up of the output curve. We are taken back by Mr. Hodgson to Dr. Clayton's storage of gas in bladders; and to the use of a cylinder, containing a bladder resting upon a disc operated by a spring, which might, inverted, be regarded as the progenitor of the waterless type of holder by removing the spring and using weights on the disc instead. Then we had Lavoisier pioneering a tiny water-sealed holder. Then came rectangular holders sealed in water; and so onwards to the cylindrical type about 1820, at which period holders of 10,000 to 15,000 c.ft. were quite fashionable, and 40,000 c.ft. ones were "enormous"—such a concentration of gas, within the limits of knowledge of those days, was regarded as dangerous. Clegg contributed to gasholder history. But a big advance was the introduction of telescoping, which greatly reduced the cost per unit of capacity and the ground space required for storage. In the middle of last century a gasholder of 250,000 c.ft. capacity was large. To-day there are in New York holders sixty times, and in this country and Australia holders 48 times, that size; and Mr. Hodgson believes that 15 million c.ft. ones are not the final word in capacity. Size has meant economy. Sir (then Mr.) George Livesey emphasized this in the extempore address on gasholder development which he delivered before the old Institution of Gas Engineers twenty-five years ago. The first gasholder he remembered being built was in 1840. Its capacity was 60,000 or 70,000 c.ft.; its cost £35 per 1000 c.ft. capacity. The last one built (at the time he was speaking, when other market and labour conditions prevailed compared with now) had cost £5 per 1000 c.ft. capacity. The engineers whose courage, enterprise, and ability made, through progressive dimensions, such large contributions to the economies of gas engineering were William Innes, Robert Jones, Thomas Kirkham, Corbet Woodall, Charles Hunt, George Livesey, and William H. Bradley (New York).

The honour of leading the way in capacious holder building can be justly claimed by the gas industry of Great Britain.

Mr. Hodgson gives in his address particulars (for those who are not acquainted with them) regarding the structural features of column-guided holders, their spiral-guided competitors, cable-guided holders (which did not gain much patronage), the tankless holder, and the spherical ones, which are favoured in America for use on high-pressure lines. Respecting waterless holders, Mr. Hodgson believes they have come to stay. So do most people—in one form or another. He suggests that "the design and construction of this new system deserve the critical examination and consideration of every gas engineer." We agree. There will also be endorsement of his statement that the tar seal "is the real crux of the holder; and the piston, together with the seal, needs the most careful designing and construction, otherwise the whole efficiency and safe working of the holder will be endangered." There is no question that, though orders for only five waterless holders (so far as Mr. Hodgson's knowledge goes) have been placed in this country, this new type has made remarkable progress in adoption in Germany—its birthplace—and in the United States. And the relatively small sizes which were first erected are being succeeded by holders running up to 10 million c.ft. capacity.

Those in the gas industry who do not know the history of the development of the gasholder any too well will find enlightenment, in compact form, in Mr. Hodgson's address. Even those who have previously studied the history will find reminder of points which may have slipped memory. Those who have regarded the gasholder simply as something of utilitarian merit will learn that it has come to us from the deep past and from small beginnings and curious devices as examined from the standpoint of to-day, which gives sanction to the title of the address—"The Romance of the Gasholder."

Gasholders and Explosions.

FOR generations gasholders have, so far as the public are concerned, been working without mishap; but recently we have had unpleasant experiences of what the newspapers term "explosions" of gasholders, and to them they have given great prominence—the terrible catastrophe to a natural-gas holder at Pittsburg being the latest. Gasholders have enjoyed public confidence for a long time. We have to see that this confidence is not undermined; and we can only do so by thoroughly investigating the causes of such accidents, and letting the public know precisely their nature. There is a great deal of ignorance, too, respecting the elementary fact that a holder filled with gas without air admixed cannot explode, and is therefore as safe as the homes of the people. Steps should be taken to dispel the ignorance.

There have been gasholder accidents at Folkestone, Manchester, and Truro. We are aware that the one at Folkestone was due to repair work being carried out by welding; the work being in the hands of a local contractor. Silence reigns over the explosion at Manchester. The Truro trouble, it is believed, was caused by an explosion in a neighbouring cottage, which upset a cable-guided holder, allowing gas to escape and air to enter. So far as we know, this explanation has not been definitely established, although it is probably true. The reports from America tell us that the cause of the disaster at Pittsburg has not been positively determined, but that, when the explosion occurred, workmen were engaged in repairing a section of one of the holders with a blowpipe. Subsequently, the information was published that the Manager of the Gas Company concerned has stated that, of "the two largest tanks on the works, one was empty, and the men were inside it making repairs. His theory is that gas leaked into the holder under repair from the full one, the two being connected by pipes, and that this caused an explosion." Piecing together the information, it seems clear that repair work was being done by acetylene welding. We do not suggest that in the Pittsburg case skilled workers were not employed. But this and a previous accident do suggest that in gasholder repairing by welding, none but really expert men should be permitted to do the work, and, even then, the utmost precaution should be taken and supervision given. These conditions were strongly insisted upon by Mr. J. N. Reeson, of Melbourne, in his paper on gasholder welding before the Institution of Civil Engineers in April of last year. He was strong in his warning that only thoroughly trained men should be allowed to do such work, and that everything possible should be done to prevent, while the work is in progress, explosions due to escaping gas. This was also emphasized by Mr. F. S. Cripps in the discussion on the paper. By the way, a cabled picture which appeared in the "Daily Mirror" on Thursday set at rest any question as to the type of holder which met with such dire end at Pittsburg. It was a column-guided one.

However, we would strongly accentuate the point that the gas industry must see to it that the public do not take fright from this crop of unprecedented gasholder accidents; and this can only be done by the fullest publicity. While on the subject, a point may be made regarding a condition which is all too common in connection with gas storage. One frequently sees gasholders exposed and not properly fenced-in, so that there is nothing to prevent undesirables gaining access to them. Such laxity should, in our opinion, be prohibited.

Union of Technical Ability in the Gas Industry.

THE Southern Association of Gas Engineers and Managers last Wednesday took a step which will meet with considerable approval in the gas industry. It affects a matter which, during the past twenty or more years, we have argued time and again; and the passing years only emphasize the validity of our submission that no barrier should be allowed to exist to prevent the utmost technical co-operation being brought to bear upon the fortunes of our industry. There has been altogether too long a division between the technical ability on the gas making and distribution side of the industry, and that associated with the development and production of the plant and appliances which are used in the manufacture, distribution, and utilization of gas, and the working-up of secondary products. The time has come when, in the interests of the industry, that division should be finally cleared away, and in no uncertain or half-hearted manner. In the electrical industry there is no such segregation, and the result is a greater technical co-operation than is evident in our industry. The times are admittedly such that we must concentrate upon our affairs the whole talent of which the industry can boast, instead of permitting it to flow as two opposing streams which at their conflux create a turbulence which has then to be composed.

The step that the Southern Association have taken is not exactly an innovation. Certain of the other District Associations long since did very much what the Southern Association are now doing, but perhaps a little more freely. However, the Southern Association have, on the suggestion of the General Committee, amended their rules, so as to enable the Committee to recommend the election as Associates of those engaged in any responsible technical position, but who are not concerned directly in the manufacture or distribution of town gas, whose experience is such as, in the opinion of the Committee, would be likely to be of advantage to the Association, and who, in addition, are either Members or Associate Members of the Institution of Civil Engineers, or are in possession of the B.Sc. degree of any British University, or other equivalent scientific or engineering degree. The resolution was submitted by the President (Mr. Thomas Hardie), seconded by Mr. A. E. Broadberry, and carried without discussion, which is eloquent of full agreement. The President said the Committee gave mature consideration to the matter, and the result is the carefully worded amendment of the rules. The Committee, he added, are very jealous of the standing which the Association holds among institutions of its kind, and they would not propose anything which, in their opinion, would result in any depreciation of that high position. It is not expected that the change will result in any great increase in membership; but it will open the door to some (if they

will accept the implied offer of membership) who would be a distinct acquisition to the Association.

We are pleased with even the measure of fusion of technical qualification that is proposed by the resolution; and therefore it would ill-become us to question the care which the Committee have taken in the matter. But the resolution as it stands does invite the suggestion that the anxiety of the Committee to maintain the high position of the Association will, to a large extent, defeat their desire to bring into closer co-operation the technical talent which exists on the side of the industry which is indispensable to the gas manufacturing and distribution side. The President says that the resolution will "open the door to some." We are afraid that it does not open the door very widely. It imposes for associates a higher technical qualification than it does for ordinary members, while we know, and all gas engineers know, that on the plant and apparatus manufacturing side of the industry there are many men of high ability, technical qualification, and experience who are not members or associate members of the Institution of Civil Engineers, and who have never attempted to obtain an academic degree. Cannot the door be pushed open a little wider, so as to admit these? It should not be—we know it would not be—very difficult for the General Committee of the Association to discriminate between applications from unqualified and qualified men, although the latter have not attached to them the particular labels which are specified in the resolution, but the possession of which would, under the terms of the resolution, in a measure, relieve the General Committee from the responsibility of determining fitness for membership. That responsibility ought not, in the interests of the industry, to be shirked. To accept it would show strength. Probably, however, the resolution as it stands to-day is merely a first step, and another will be taken later that will remove the ties which the closing lines of the resolution impose. We are encouraged to think this by the fact that a generous view of the matter was taken by the seconder of the resolution, Mr. Broadberry; and there is much wisdom in his remarks: "The time for "restricted circles governing membership has gone by. "Restriction simply means living on our own intelligence, "without any assistance from outside; and this tends "to cripple expansion, not only in the Association, but "in the industry itself." The resolution inflicts a restriction before we get to the boundary of genuine technical qualification among the men who are principally concerned in the modification of the rules.

However, as the President puts it, the door is now open—perhaps not very widely—to those technical men on the plant and apparatus manufacturing side of the industry who have the necessary qualifications, and they are invited to become more intimately identified with the work of the Association. We hope they will respond to the invitation; also that the change will help to forward the day when the Institution of Gas Engineers will be a body comprehensive of the whole engineering talent of the industry. Common sense and modern requirement, and not an absurd traditional rule, should govern in this matter.

A Coal Marketing Association.

The colliery owners of Monmouthshire and South Wales have resolved to form forthwith what is to be known as the South Wales Coal Marketing Association. This, of course, means simply an agreed regulation of prices to the extent of imposing a minima scale for different grades of coal, and any infraction will cause the offenders to incur heavy penalties. The fact that the scheme (which, previous to acceptance, was kept very secret) has been adopted, evidences a unanimous opinion among the proprietors of the South Wales collieries that the economic state of their section of the coal industry demands some form of definite regulation in respect of trading. But the future of the scheme, whether it meets with success or otherwise in helping to restore the fortunes of the South Wales industry, must depend upon the willingness of the buyers to pay the minimum or higher prices. South Wales is not the only quarter from which coal can be purchased; and a large part of the South Wales output is for export, and export trade is subject to competition from other countries. It is not clear whether the conditions the South Wales collieries have been suffering are due to under-cutting locally, or to competition from elsewhere—at home and abroad—or to both circumstances. If the latter is the cause, their minimum prices, we imagine, will not avail much in producing restoration of prosperity; if the former, which we fancy must be the case, then the scheme may have a beneficial effect for the collieries, always providing buyers are willing to pay and cannot fill their requirements at lower prices elsewhere.

The details of the new Marketing Association have yet to be formulated; that there will be no delay in the formulation is assured by the fact that Mr. Finlay A. Gibson is the Secretary. Mr. Gibson has made it known that the two main principles of the scheme are: (1) A contribution from the colliery companies of 3d. a ton on their output to a pool which would be available for compensating companies whose collieries lose shifts through want of trade caused by their not accepting prices below their economic values. (2) The collieries in South Wales are to be divided into groups according to the description and grading of the coal produced; and, further, a Committee of each group are to take such steps as may be necessary to stabilize prices. Proposal No. 1 reflects an anticipation that there will be collieries which will lose trade by being bound to the minimum prices, or, as described, "economic values." The whole object of the scheme, Mr. Gibson acknowledges, is to get the best price possible for South Wales coal. Buyers will look a little askance at that, though no one can blame the colliery owners, so long as "best price" means "fair price," and provided such machinery is not generally used to the oppressive disadvantage of buyers and the country. The combination has other objects which may allay some of the apprehension among buyers as to the probable issue of this organization. There is to be no restriction or allocation of output; and another purpose is to reduce the cost of production by more regular working, and, if possible, to increase the volume of the export trade. If there is success in these directions, buyers will hope that the minima scale will be of an order which will enable them to carry on satisfactory negotiations for their coal requirements. However, it will be necessary to await experience before giving a final verdict upon the scheme. One possibility in this regard is that, before obtaining experience from one coal area, other areas may see fit to enter into similar arrangements. There is no open indication of this yet. But it is well known that the movement in South Wales is being closely watched and examined in other quarters.

Labour in the industry seems to be rather favourably inclined to universal selling agencies being established. Mr. G. A. Spencer, M.P., Agent of the Miners' Industrial Union, and Mr. F. B. Varley, M.P., Agent of the Notts. Miners' Association, rivals in other matters, are both favourably inclined to this. Mr. Spencer is reported to have said that he would unhesitatingly make a bargain with the coalowners that, if they would establish coal-selling agencies for ten years, he would drop all question of nationalization, or any such change in the economic character of the industry, provided the owners would make the organization as efficient as possible. "Economic efficiency," in his opinion, "is more important than mere political change." Of course, the idea of the miners' leaders is that such selling agencies will prevent consumers getting coal at prices which limits the miners' chances of getting more wages—in other words, more pay per ton of coal raised, which item is the heaviest in the cost of production. They overlook the fact that the coal position is due not only to home but to international economic conditions, and that the law of supply and demand does not in its operation exclude price as a factor.

Riddle of an Explosion.

An esteemed engineering correspondent in Scotland contributes to our columns this week an article which gives an account of an explosion in a new 24-in. gas-main. It will probably set gas-distributing engineers pondering over the cause. Our correspondent has set-out all the information he has at his

disposal. It is the cause of the explosion which is the riddle, and which requires solution. If anyone has a theory to submit, we shall be pleased to hear from him.

The Companies Bill.

The Prime Minister stated in the House on Thursday night that, in view of the state of parliamentary business, it will not be possible to take the Companies Bill this session.

Atmospheric Pollution.

The London County Council have appointed Mr. J. P. Blake and Mr. Cyril H. M. Jacobs as their representatives on the Standing Conference of Co-operating Bodies set-up by the Department of Scientific and Industrial Research in connection with the investigation of atmospheric pollution. In July, 1926, the L.C.C. had their attention called to the subject of the inquiry by the Department in co-operation with local authorities into atmospheric pollution and the cause of fogs; and they then decided to make a contribution of £100 a year for three years towards the expenses. The Standing Conference of Co-operating Bodies is to be consultative and advisory; and Sir Napier Shaw is the first Chairman.

"Obsolescent" Gas-Works.

The Bingley Chamber of Trade appear to have crude notions concerning the position of gas supply as a public utility. The Gas Committee have under consideration a scheme of works reconstruction; and the Chamber, in their monthly bulletin, state that their "Executive have considered the proposal most carefully, and in view of the rapid progress in consumption and production of electricity, and the certainty that within a few years it will entirely have superseded gas as an illuminant and for power purposes, if not also for heating and cooking," they feel that the District Council should postpone consideration of any such scheme for ten years at least. Another reason for this is that the "capital expenditure as proposed must for a long period increase the cost of gas." The views of the Executive are a contradiction of careful consideration, or, if their consideration was of a careful character, then at the base of it there was something peculiarly unsound. The Chamber seem to be unaware of the fact that the postponement of reconstruction for ten years at least would mean that the supply of gas would be inadequate; and the cost would be considerably higher than it will be by incurring expenditure on reconstruction. Moreover, they have not a very clear conception of the position of gas at the present day. The Chamber Executive would obtain much enlightenment by reading the editorial article, entitled "A Highly Creditable History," in the "GAS SALESMAN" for Nov. 16. The "certainty" felt as to the supersession of gas by electricity is as foolish as anything we have heard for a long time. Perhaps there will be a revision of ideas when the data contained in the article referred to (if brought to the notice of the members of the Chamber) have been studied and inwardly digested by them.

Rapid Meter Reading.

The New York Edison Company believe in their meter readers visiting every meter once a month. This is gathered from an address recently delivered by Mr. H. M. Smith, of the Accounting Department of the Company. In Manhattan and The Bronx, there are 900,000 meters; and each one is visited within a period of twenty-five days each month, or at the rate of 36,000 meter readings per day. Each meter reader averages about 200 readings a day, which means about 30 readings an hour, or one every two minutes. Our meter readers who have many stairs to climb, dark cellars to descend, and are sometimes kept waiting before they can obtain admission to buildings, will wonder how this is done, and accuracy ensured. We cannot tell them.

Railway Rates.

The Railway Rates Tribunal have determined that the "appointed day" upon which the new standard charges approved by them under the Railway Act, 1921, are to come into force shall be Jan. 1 next. In order to facilitate the carrying out of section 36 of the Act, the railway companies are to record all existing exceptional rates in rate books to be placed at appropriate stations. It is advised that all undertakings should inspect these books, in order that, if a particular rate is recorded as "proposed to be adjusted," steps may be taken to put in a claim before the railway company concerned. It is important that undertakings should understand their position in connection with this matter. If there is any question, no doubt information can be obtained from the office of the National Gas Council.

Durham Miners' Wages.

It will be a relief to those gas undertakings who draw their supplies of coal from Durham to know that there is not to be any trouble in connection with the expiration of the first wage agreement entered into at the end of the coal stoppage. Last Saturday week, the Durham Miners' Association held a meeting, at which they decided to recommend the lodge meetings to accept the final proposals of the colliery owners for a revision of the existing agreement. The owners had asked for a reduction of the present subsistence wage, and of the minimum percentage which is added to the basic rate, but suggested that, if the Association agreed to the inclusion in the county agreement of a clause similar to that in the Northumberland agreement (which gives either side an opportunity after a month's notice to bring the question of the minimum percentage before the independent Chairman), no further action would be taken by them, and a new agreement would be mutually determined. It was announced towards the end of last week that, by an almost unanimous vote, the branches accepted the recommendation of the Miners' Association. The decision assures that there will be no stoppage of work, that present wages will continue to the end of February, and that, failing mutual arrangement, the independent Chairman will decide the minimum percentage for March.

Closed Coal Mines.

In the House of Commons last week, Colonel Lane-Fox, Secretary for Mines, gave the information that, during the past twelve months, 286 pits employing 43,000 wage earners had been closed for economic reasons, and had not been re-opened.

PERSONAL.

Sir DAVID MILNE-WATSON, LL.D., D.L., was last Wednesday unanimously elected an Honorary Member of the Southern Association of Gas Engineers and Managers.

Owing to continued ill-health, Mr. A. W. ELTON, Engineer and Manager of the Littlehampton Gas Company for the past 32 years, has had to resign his position; and on account of his long service with the Company, the Directors have granted him a generous superannuation allowance. Mr. Elton hopes to take up his residence at Eastbourne early in the new year.

Two new Directors have been appointed to the Board of the Cardiff Gas Light and Coke Company. They are Mr. ERNEST A. PROSSER, C.B.E., J.P., and Mr. WILLIAM WARE, J.P. Prior to his retirement, Mr. Prosser was General Manager of the Cardiff Railway and Docks and the Rhymney Railway and Taff Vale Railway. Mr. Ware is the senior partner of the firm of Messrs. Ware & Corbett, estate agents and surveyors, of Cardiff.

OBITUARY.

Deep sympathy is felt with Mr. and Mrs. ROBERT ROBERTSON in the loss of one of their sons, at the early age of 21, after only a few days' illness. Mr. Robert Robertson is the Engineer at the Bristol Gas-Works, and his son was with him in the Gas Company. He was a very promising young fellow, having graduated last year as a B.Sc. at Bristol University, and was afterwards a pupil at the Gas Company's works, where he was very popular among his colleagues. He took a keen interest in the industry, and was a member of the recently-formed Western Junior Gas Association.

Mr. FRANK WORKMAN, D.L., who has just died, was for many years Chairman of the Belfast Corporation Gas Committee; and during his office some of the most important extensions of the undertaking were carried out. Mr. Workman was one of the founders of the famous Belfast shipbuilding firm of Workman, Clark, & Co., Ltd., from which he retired a few years ago. He was a former High Sheriff of Belfast and of County Down.

ELECTRICITY SUPPLY MEMORANDA.

SINCE the passing of the Electricity Supply Act, 1926, the Government have had much side-light thrown upon their erroneous notion that the scheme of centralizing electricity generation was going to effect a great reduction of the cost of supplying rural areas. The latest evidence that a mistake was made is furnished by the Unionist Agricultural Committee of the House of Commons, who have issued a report on the application and use of electricity in the rural territories of other countries. It appears that during the recess Sir Douglas Newton and Sir Mervyn Manningham-Buller have made an investigation of the problem in Sweden and other lands. They emphasize the fact that the cost of generating electricity is not the principal factor which determines the price the country consumer has to pay. Whether current is generated at a cost of ½d. or ¼d. per unit does not greatly affect him; the important factor is the need of a cheap method of distribution. Hence the need, the reporters submit, of simplification in regard to regulations respecting the erection and protection of overhead lines, materials used, length of spans, height of poles, &c. They show that lines are built in Sweden at under £200 per mile; but few, if any, lines in this country are constructed at a cost under three times that figure. This shows that the capital charges involved render cheap distribution of current almost impossible. A suggestion is made that farmers' associations should take part in the development. The electricity companies are not willing to risk the money of their shareholders in the exploitation of rural areas, from which, at best, only a moderate return can be expected, while so many more remunerative small towns and industries still remain unsupplied. The report says that such undertakings are quite prepared to sell in bulk to associations of farmers; and such associations are in most cases in a position to distribute cheaply by reason of their facilities for obtaining wayleaves, and for using their own direct labour for the erection of poles.

Supply in Rural Areas.

The Committee make certain recommendations. The most important one is that a Rural Electricity Parliamentary Committee should be set up, and that the Government be requested to put aside funds for the electrification of rural areas by approved associations on easy terms. Here, again, we get the suggestion of Government aid for electricity, which consideration is denied to other industries, and this notwithstanding the frequent efforts of technologists to impress upon the Government that the provision of cheap heat is of greater importance than the provision of cheaper power than is already possessed. There will be great opposition to the absolute power which the Committee suggest should be vested in the Electricity Commissioners. Their idea is that this body should be a complete and unchallengeable authority in respect of such questions as wayleaves, methods of construction, protection, and kindred matters. Apparently, too, they desire that the Electricity Supply Act, 1926, should be over-ridden, by ordaining that "in future authority in respect to the transmission of electricity should rest solely with the Electricity Commissioners." They also submit that the Commissioners should have their number increased by a representative of rural interests. It is difficult to see why rural interests should have a component in the membership of the Commissioners any more than other interests. The next suggestion is of a more modest character. The Ministry of Agriculture should be asked to assist in the formation of rural associations for the provision of electricity in country districts, and to take steps to point out to agriculturists the need of action on their part if electricity is to be available on "easy terms" in rural areas. Finally, it is recommended that the Development Commissioners should be requested to formulate plans for the electrification, on Continental lines, of a typical rural experimental area at a cost not exceeding £250 per mile, and that the Commissioners, in consultation with the Rural Industries Bureau, should set-up an Advisory Committee on Electricity for Rural Areas. Statutory electricity undertakers will also rejoice to learn that the Unionist Agricultural Committee are of opinion that they "should be required to submit schemes for the rural electrification of their areas within a reasonable period, subject to the approval of the Electricity Commissioners, and to grant facilities to any persons or associations willing to assist with developments."

Recommendations.

"Meteor" of the "Electrical Times" is vastly concerned over the number of employee displacements there will be through the coming of generating centralization and the operation of the grid. He finds it a big question, and hopes that a lot more will be heard of it. There can be little use talking much about it. The edict has gone forth that work is to be done which will mean a considerable expulsion of men from the industry—both staff and station workers. There is a certainty, too, that the new limitations for technical ability in the industry will have the effect of lessening the attractions of the electrical profession for young fellows who would otherwise have chosen it for their life's work. Already we have heard of students who have been looking-up information as to stations which are, or are likely, to be selected ones, in the hope that they may get on to the staff of one of them. But in those stations there can only be one technical chief; and it will be a long, long way to the headship, and few there will be to get there. There are the existing station staffs which will have to be displaced. "Meteor" says it has been calculated by those who have gone very carefully into the estimates for the South-East of England scheme—and this is only one of several—that between 5000 and 6000 employees will have to seek work elsewhere. The work to which they are accustomed will not be available in other areas, in which, of course, there will also be a large number of evictions. What is to happen to them all? sadly asks "Meteor." Compensation for displacement has a hollow sound about it, when consideration is given to its amount in relation to the loss of a permanent job. It is pointed out by our contemporary that the fourth schedule of the 1926 Act provides that, if an employee can prove to the satisfaction of the Board of Referees that he has lost his job as a result of the scheme, and that he could not obtain an equally good appointment elsewhere, there shall be paid to him by the undertakers, or the acquiring authority, such compensation as the referee or the Board of Referees may award. While this concerns many, it does not, of course, embrace all the station men. "Meteor" says many difficult questions arise out of this matter; and among them is the fact that all of the discharged workers cannot be taken on to distribution and sales work. There is not room for flooding the commercial side of the business with men who perhaps are highly competent in the work they have been doing, but might not be able to adapt themselves to the needs of the trading end. The Government have in this respect succeeded in creating an unpleasant problem, but one which has to be faced.

Generating Unemployment.

In connection with the six months' electrical campaign (which seems to be pursuing a course which is not attracting much attention), readers will remember that there is to be a National Electric Week from Dec. 3 to 10. It is announced that so far an aggregate of only 500 electrical undertakings and contractors have announced their intention of participating. The idea is that during the week those concerned shall make small electrical appliances a feature of their showroom and shop windows, which should be made as magnetic as possible by bringing to bear enthusiasm and inventive faculties. The small electric appliances, it is thought, will appeal to the public as being suitable for Christmas and New Year's presents. Named as useful for that purpose are kettles, toasters, percolators, shaving-pots, hair-driers, curling-tongs, irons, cleaners, &c. The users of these will, it is hoped, be so charmed with them that they will want to purchase cookers, water-heaters, and heavily loaded fires. Talking of heavily loaded fires, we saw in the "Evening Standard" the other day a letter by a lady in which it was stated that she used an electric fire for fifteen hours one day, and found that she had consumed 8s. worth of electricity. We suppose this was a 3 KW.H. fire, and that the price per unit was 2d. However, during National Electric Week, "E.D.A." are going to advertise in a number of newspapers, recommending people to give electrical presents this Christmas time. It is hoped that there will be a *quid pro quo* on the part of the newspapers in the shape of articles and other references to the National Electric Week, and to the wonderful merits of electrical operation.

An Electrical Christmas.

The manner in which the electrical people play at water heating, and try the patience of those whom they succeed in inveigling into adopting their methods, is well illustrated by an article on a thermal storage cylinder which appeared recently in the "Electrical Times." The cylinder is a 2-gallon one, intended for use at kitchen sinks, lavatory basins, &c. It is stated that by combining the principle of feed-water pre-heating, with a relatively high electrical loading, a very useful output has been secured. "When the tank is fully heated up—as it will be during the night—there is available practically 2 gallons of boiling water." Magnificent! "This, it is contended [why is it contended?], is ample to meet hot water requirements for breakfast and washing-up thereafter." Of course, washing-up would not be done therebefore. "Subsequently, even if the full quantity of hot water has been run out, the tank will yield a further 1 gallon of water at full temperature every 20 to 25 minutes." Such rapidity causes us to pause to take breath. We ask to be allowed to continue heating water by the gas geyser or coke boiler. There was a paragraph, headed "The Conversion," in an early part of the "JOURNAL" last week, which told of the eviction from a coffee shop in Marylebone—first, of an electric water heater, and then of an electric roaster and cooker. The former was

Water Heating.

displaced by a coke boiler; the latter by a large double gas cooker.

Objections to the "S.E." Scheme.

We learn that the Central Electricity Board have received a number of objections to particular points in the South-East of England electricity scheme, which covers the enormous area of 9000 square miles, and embraces no less than 165 authorized undertakings. The period within which objections had to be lodged expired on Tuesday night of last week. While the number of objections is large, it is hinted that in no case are they of a character which will vitally affect the scheme, which will be adopted by the Board either with or without modification. In the initial stage, the scheme provides for five new generating stations, the largest of which will be at Battersea, on a 15-acre riverside site near Victoria Bridge. This, it is estimated, will cost £5,000,000; and it is expected that it will be in active operation by 1932, or the following year. In 1934, another large station will be erected at Chiswick; and Little Barford, near St. Neots, has been selected as the site for a further station, the first section of which will be the provision of only 25,000 KW. The fourth station will be constructed in the eastern area, and will provide initially for 200,000 KW. It will have to be ready for operation by 1938. The site has not yet been chosen for the fifth station, which will not be required until 1940.

Mishaps.

On Tuesday of last week, the Tivoli Cinema in Sheffield was converted into what the newspapers term a "raging furnace." How the fire started report does not disclose; but the firemen say that, owing to the electric wires being burnt through, the building was at one time electrified. They felt the electricity as they walked through the water, and got a shock if they touched a hand-rail or any metal in the building. Fortunately, however, the current was not strong enough to hamper them seriously; and eventually they were able to cut-off the supply from the main switch in the cellar. On the 11th inst., there was a fire in a house at Strathmarine Road, Dundee. Flames were observed shooting from the floor of a bedroom; and no one can attribute them to anything else than the fusing of an electric wire. The pastor of the Baptist Church at Hay, Breconshire, just recently was somewhat perturbed when making certain announcements from the church rostrum. A large electric light globe installed immediately over the rostrum burst with a loud report; the glass being scattered in all directions. The reverend gentleman had a narrow escape. There was a big collapse of the Marylebone electricity supply in the West-end on Nov. 7; the failure lasting an hour-and-a-half. Oxford Street—from Orchard Street to the Marble Arch—and an adjoining area were affected, involving the Mayfair Telephone Exchange, the Western District Parcels Office, and many Oxford Street shops. At the parcels office, it is stated, there was considerable confusion and delay. Candles and oil-lamps were hastily obtained; and large quantities of mail had to be sent to the office at Mount Pleasant, where the sorting was carried on.

EVENING STAR CHAPTER, No. 1719.

There was a good attendance at the election convocation of the Evening Star Chapter, No. 1719, which took place on Nov. 9 at Freemasons' Hall, Great Queen Street, London.

The chairs were occupied respectively by the M.E.Z. Ex-Comp. Charles Clare; Ex-Comp. Rae P. Normand, H.; and Ex-Comp. W. McDowall, J.

Feeling reference was made at the opening of the proceedings to the loss which had been sustained by the chapter since the last meeting by the untimely death of Comp. Hermann L. Sheppard.

Comp. P. H. Sugg, a new exaltee, received his Grand Chapter certificate; and Bro. Wilfred James Chandler, of Radiant Lodge, No. 4200, having been duly balloted for and elected as a candidate for exaltation, was admitted to the chapter and became a companion of it in the regular course. Ex-Comp. Alfred C. Beal, P.Z., performed his duties as Scribe E.; Ex-Comp. Arthur Valon, P.Z., as Scribe N.; and Comp. W. W. Hammond as P.S.

The ballot for the election of Principals and Officers for the year 1927-28 was taken, and the M.E.Z. declared the following to have been elected:

Z.	Ex-Comp. Rae P. Normand.
H.	,, W. McDowall.
J.	Comp. Wallace W. Hammond.
Scribe E.	Ex-Comp. Alfred C. Beal, P.Z.
Treasurer	,, W. A. Surridge, P.G.Std.B., P.Z.
D.C.	,, Charles Hulme.
Scribe N.	Comp. J. Fred Wicks.
P.S.	,, G. D. Bidwell
1st A.S.	,, H. Dashwood.
2nd A.S.	,, J. R. Masters.
Stewards	Comps. C. M D. Belton and Burt Long.
Janitor	Ex-Comp. R. H. Goddard.

In recognition of the unvarying interest which he has always taken in the work of the chapter, it was agreed that a past-principal's jewel be presented to Ex-Comp. Clare on the occasion of his retirement from the Z. chair.

The chapter having been regularly closed, the companions proceeded to the adjoining Connaught Rooms for dinner. During the course of the evening the usual list of Royal Arch Chapter toasts was gone through. The presence of Ex-Comp. William Belton, P.Z., who responded to the toast of "The Grand Officers, Present and Past," gave the members and their guests especial pleasure. Some exceedingly well-rendered musical items were interspersed with the toasts, and added to the enjoyment of the evening.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Nov. 24.—MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.—Quarterly meeting in Leeds.

Nov. 25.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute, 7.30. Paper by Mr. T. Campbell Finlayson.

Nov. 26.—MIDLAND JUNIOR GAS ASSOCIATION.—Visit to the works of the Parkinson Stove Company, Ltd., at Stechford.

Nov. 29.—BRITISH COMMERCIAL GAS ASSOCIATION.—Executive and General Committee.

Dec. 3.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Meeting in the Royal Technical College, Glasgow. Paper by Mr. J. Boyle, of Greenock, on "The Manufacture of Pure Liquid Ammonia." Mr. D. Melvin, of Uddingston, will read his thesis which gained the Diploma of the Institution of Gas Engineers.

Dec. 3.—WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Porth. Visit to the Miners' Rescue Station, Dinas. Paper by Mr. T. Noall on "Co-Partnership."

Dec. 3.—WESTERN JUNIOR GAS ASSOCIATION.—Visit to the Stapleton Road Works, the Canon's Marsh Works, and the Barton Street Stove and Meter Workshops of the Bristol Gas Company.

Dec. 3.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.—Half-yearly auxiliary meeting in Sunderland.

Dec. 6.—BRITISH COMMERCIAL GAS ASSOCIATION.—West Riding of Yorkshire District Committee, at Leeds.

Dec. 7.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Cyclops Tube Works of Messrs. Le Bas Tube Company, at Millwall.

Dec. 7.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Ship Canal Portland Cement Manufacturers, Ltd., Ellesmere Port. Paper on "Portland Cement and its Uses," by Mr. H. J. Gillett (Chief Chemist).

Dec. 8.—BRITISH COMMERCIAL GAS ASSOCIATION.—Midland District Committee, at Birmingham.

Dec. 10.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Visit to the Granton Gas-Works, Edinburgh.

Dec. 13.—NATIONAL GAS COUNCIL.—Meeting.

Dec. 13.—FEDERATION OF GAS EMPLOYERS.—Meeting.

Dec. 15.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting at the Council House, Birmingham. Papers by Mr. A. E. Adey on "Town Gas for Power," and Mr. J. S. Hayward (Industrial Heating Section, Birmingham) on "The Heat Insulation of Materials."

Dec. 16.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute, 7.30. Paper by Mr. J. M. Loughland on "Gas-Fired Fish-Frying Ranges."

Dec. 17.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Brighouse. Paper by Mr. W. E. Stephenson, of South Bank, on "Incidentals in the Manufacture of 400 c.v. Gas." Inspection of the works.

INSTITUTION OF GAS ENGINEERS.

Dec. 12.—Emergency Committee.
Finance Committee.

Dec. 13.—Education Committee.

Collins' Engineers' Diary.—The 1928 edition of this useful diary has just been published. It contains a vast amount of information—120 pages—on engineering in general; and there is a section devoted to gas engineering. The matter is well arranged for quick reference purposes, and a full index of contents is provided. The fast-bound editions vary in price from 2s. to 4s. 6d., according to binding, and the renewable editions from 6s. to 7s. The refills for renewable cases are issued annually at 1s. 6d.

LECTURES TO SMOKE INSPECTORS.

The programme was reproduced on p. 273 of the "JOURNAL" for Oct. 26 of a series of lectures and demonstrations to assist candidates in the examination to qualify them for the post of smoke inspector. The lectures extend from Nov. 4 to Dec. 5; and brief abstracts of some of the earlier ones appeared last week (p. 469).

FURNACES.

By R. J. SARJANT, A.R.C.S., M.Sc.

The lecture was intended to describe the essential features of furnace construction, and to indicate the various types in use and the purposes for which they are employed. It was illustrated by a considerable number of lantern slides. The furnace problem, from a smoke inspector's point of view, is a complicated one, for it generally resolves itself into "a furnace to fit the job," the variables of which may be legion.

Attention was directed to the guiding principles to be considered in assessing the value of any furnace for a particular use. First comes adaptability; then flexibility in output. The main function of the furnace is to give a satisfactory product, as to degree and uniformity of heating, consistent with those conditions and variations which the shop imposes. Then comes the question of mechanical stability and ease of control, involving some consideration of the skill and intelligence of the personnel. Since the cost of fuel is a recurrent charge on the operation, far outweighing the capital charges, it necessarily follows that the aspect of fuel economy is an important one.

Looking ahead, one may venture to say that the development of the mechanical furnace must be the natural development of a mechanical age. It is only truly adaptable to mass production methods; and there are serious difficulties in the sense of the limitations of the properties of the refractory materials and metals used. But recent metallurgical advance in the production of heat-resisting steels promises to expedite progress.

Reference was made of the technical difficulties underlying the exclusion of smoke from metallurgical operations. In certain industries, there is a sound technical basis for the utilization of smoky atmospheres in the furnace chamber. That is to say, in the present state of knowledge it cannot be done without. Recent research serves to confirm this conclusion.

PRINCIPLES AND PRACTICE OF STOKING.

By E. W. L. NICOL, Assoc.Inst.C.E.

In the course of his lecture on the above subject, Mr. Nicol said the main object of combustion in boiler practice should be to maintain in the furnace the highest temperature that conditions and circumstances will allow. Probably the principal cause of smoke formation and emission is low furnace temperature, due to insufficient or misapplied draught. The furnace temperatures attainable in ordinary circumstances depend not so much upon the calorific power of the fuel as upon its composition. Some fuels require more, and some less, excess air to effect their complete combustion; and smokeless fuels are naturally the most efficient. The cooling effect of excess air is similar to that of cold feed water. It tends seriously to reduce temperature; and, inevitably, the more excess air, the lower will be the furnace temperature, and the greater the tendency to form smoke. There are other contributory causes—such as bad furnace conditions and high specific heats, or cooling effect of the fuels used, and sometimes insufficient air—but the main cause usually is too much cold air, together with heavy stoking at long intervals.

Theoretically, one pound of bituminous coal requires about 12 lbs. of air for its complete combustion; but in practice 18 lbs. is regarded as about the minimum needed. The corresponding furnace temperature, with this proportion af air, is about 2750° Fahr. At this temperature, the gases evolved from the coal ignite and burn completely without the formation of visible smoke; there is a maximum of radiation from the fuel; and the greater the radiation, the lower will be the chimney losses, and the more effective becomes the transmission of heat to the water and steam inside the boiler. The corresponding CO_2 content of the flue gases is about 12 to 13 p.ct.; and these conditions represent what may be regarded as first-class practice in the case of coal-fired boilers. In ordinary practice, 6 to 8 p.ct. CO_2 is quite usual, and often more than the average; the corresponding furnace temperatures being of the order of 1300° to 1570° Fahr.—too low by 1000° to effect rapid ignition and complete combustion of the volatile gases, with consequent smoke formation and waste of fuel amounting to 25 p.ct. or more.

As an indication of the influence of chemical composition upon the amount of excess air actually required in burning different kinds of boiler fuels, coke, which is almost entirely devoid of hydrogen or volatile matter, requires less than half the amount of excess air usually allowed for coal, and gives 14 to 16 p.ct. CO_2 in ordinary practice, with a correspondingly high temperature and radiation. That is one reason why coke is amost invariably used where high temperatures are required, as in steel melting.

The first principle to be observed in stoking should, therefore, be to exclude from the furnace, so far as is practicable, all cold air in excess of than necessary to burn the fuel at the highest possible temperature. But this quantity of air in ordinary practice falls short of that needed to burn raw coal completely.

While the carbon content of black smoke may represent only a relatively small loss of fuel, the incidental heat losses due to the uncontrolled use of cold air in excess of that necessary is recognized to be one of the greatest preventable losses in industry to-day. Excess air is frequently used in a genuine effort to prevent smoke emission; and by adopting merely punitive methods, and inflicting penalties for contravention of the Smoke Abatement Act now in operation, it is quite possible that the already enormous waste due to this cause may be aggravated.

Greater London uses on the average 50,000 tons of coal a day; probably 15 to 20 p.ct. is sheer waste. Smokeless combustion and efficient combustion are largely synonymous terms; and by precept and sound instruction local authorities may, through their qualified smoke inspectors, materially assist industry by effecting economy in fuel use, and restore to our smoke-afflicted city a full measure of light and sun.

FROM AN ENGLISH TO AN AMERICAN POLYTECHNIC.

An evening course consisting of twenty lectures and twenty laboratory sessions dealing with the principles underlying the manufacture, distribution, and utilization of manufactured gas was started in October; the Brooklyn Union Gas Company of New York and the Polytechnic Institute of Brooklyn co-operating in presenting the course, in which are enrolled students from the sponsor Company and three other Gas Companies in the New York metropolitan area. This work is under the direction of Prof. Edwin F. Church, Jun., Head of the Department of Mechanical Engineering, assisted at times by specialists from the gas industry.

An interesting coincidence lies in the fact that the lecturer on the production of coal and carburetted water gas, Mr. A. Gordon King, Service Engineer of the American Gas Association, showed the class his notes, taken 23 years ago to the day, when a student at the Polytechnic, Regent Street, London. Mr. King was a student and a prize winner under Mr. Walter Grafton, now at Glasgow. In 1905 he was awarded a first-class honours grade certificate in Gas Manufacture and the preliminary qualifying subjects by the City and Guilds of London Institute.

The Polytechnic Institute of Brooklyn students listened with interest and amusement as the lecturer read from his indentures, to which the late Mr. Joseph Davis, General Manager of the Gravesend and Milton Gas Light Company, and his father, the late Mr. Arthur King, General Manager of the Gravesend and Milton Water Company, attached their signatures as master and guardian respectively. The paragraph in question was as follows:

> To learn his professions of a Gas Engineer and Manager of Gas Works and with him and after the manner of an apprentice to serve as from the first day of January one thousand nine hundred and three until the full end and term of three years thence next following to be fully complete and ended during which term the said apprentice his master faithfully shall serve his secrets keep his lawful commands everywhere gladly do he shall do no damage to his said master nor see the same to be done of others but to his power shall tell and forthwith give warning to his said master of the same he shall not waste the goods of his said master nor lend them unlawfully to any he shall not *contract matrimony within the said term* shall not play at cards or dice tables or any other unlawful games whereby his said master may have any loss with his own goods or others during the said term without license of his said master he shall neither buy nor sell he shall not haunt taverns or playhouses nor absent himself from his said master's service day or night unlawfully but in all things as a faithful apprentice he shall behave himself towards his said master and all his during the said term.

River Pollution Advisory Committee.—The Minister of Health and the Minister of Agriculture and Fisheries have appointed a Joint Advisory Committee to consider, and from time to time to report on, the position with regard to the pollution of rivers and streams, and on any legislative, administrative, or other measures which appear to them to be desirable for reducing such pollution. The membership of the Committee is: Sir Horace C. Monro, K.C.B. (Chairman); Mr. A. R. Atkey, J.P.; Rear-Admiral T. Beamish, C.B., R.N., M.P.; Mr. Reginald Beddington; Mr. Herbert E. Brooks; Mr. J. T. Conroy, D.Sc.; Mr. Stephen Easten; Mr. C. N. Hooper; Mr. F. E. Warbreck Howell; Mr. L. Holme Lewis, M.Inst.C.E., M.Inst.M.E.; Mr. W. Prescott; Lieut.-Colonel D. Watts-Morgan, C.B.E., D.S.O., M.P.; and Mr. H. Maclean Wilson, M.D., B.Sc. The Secretaries are Mr. G. C. North, M.C., of the Ministry of Health, and Mr. H. Meadows, of the Ministry of Agriculture and Fisheries. All communications should be addressed to Mr. North at the offices of the Ministry of Health, Whitehall, S.W.1.

SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

GENERAL MEETING IN LONDON.

A General Meeting of the Association was held at the Hotel Cecil, W.C. 2, on Wednesday, Nov. 16—Mr. T. HARDIE (the President) in the chair.

The minutes of the previous meeting (as published in the "JOURNAL") were taken as read, and confirmed.

ELECTION OF NEW PRESIDENT.

The PRESIDENT proposed that Mr. C. Valon Bennett, of Rochester, be elected President of the Association for 1928. Irrespective of Mr. Bennett's qualifications, he said, as the Engineer and Manager of a progressive gas undertaking, the interest he had taken and the useful work he had done during his period of office as Vice-President singled him out as one who had the well-being of the Association at heart, and as one who, as President, would maintain its traditions and further its objects. Therefore, he had very much pleasure in proposing Mr. Bennett's election.

Mr. W. E. DEAN (Exmouth), seconding, said he had known Mr. Bennett more or less intimately since he had become a member of the Association, and he heartily endorsed everything the President had said.

Mr. Valon Bennett was unanimously elected.

Mr. VALON BENNETT, returning thanks for his election, assured the members that he would do his best to uphold the dignities of the office. He expressed the hope that when the time came to hand over the office to his successor, the members would not regret having elected him.

ELECTION OF VICE-PRESIDENT.

Mr. BENNETT proposed the election of Mr. W. E. Dean as Vice-President for 1928.

Mr. J. H. CORNISH, seconding, said that as Chairman of the Western Section he regarded it as an honour that Mr. Dean had been nominated as Vice-President. Mr. Dean had rendered yeoman service to the Western Section during the six years he had acted as its Secretary, and there was not the slightest doubt about the wisdom of electing him Vice-President of the Association. He hoped Mr. Dean would eventually occupy the chair, and that he would serve the Association with distinction and with honour to himself.

Mr. Dean was unanimously elected.

Mr. DEAN, in thanking the members for the honour they had done him, said that when Mr. H. C. Smith (the Hon. Secretary) had asked him to allow his name to go forward he had felt somewhat diffident, because it was pointed out to him that possibly he would ultimately be elected to the chair. He assured the members, however, that he would do his best to uphold the dignity of the Association.

GENERAL COMMITTEE, DISTRICT COMMITTEES, AND DISTRICT EDUCATION COMMITTEES.

The HON. SECRETARY reported the following elections by the Districts:

EASTERN DISTRICT.

Chairman.—Mr. A. W. Sumner.
Vice-Chairman.—Mr. H. C. Smith.
Hon. Secretary.—Mr. L. Trewby.
Committee.—Messrs. A. H. Andrews, W. H. Bennett, D. C. Cross, T. Carmichael, H. Gage, L. G. Humphrys, S. Lacey, L. J. Langford, C. T. Price, R. H. Ruthven, C. H. Rutter, W. J. Sandeman, J. Terrace, J. S. Thorman, J. Urquhart, and W. H. Warren.
Representatives on the General Committee in place of those retiring by rotation.—Messrs. L. G. Humphrys, C. T. Price, and R. H. Ruthven.
Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. L. G. Humphrys, R. H. Ruthven, E. Scears, and L. Trewby.
Representative on the Council of the British Road Tar Association.—Mr. L. Trewby.

WESTERN DISTRICT.

Chairman.—Mr. W. E. Dean.
Vice-Chairman.—Mr. J. Taylor.
Hon. Secretary.—Mr. J. B. Cattle.
Committee.—Messrs. J. Armstrong, J. Hughes Cornish, C. G. Dawson, S. E. Halliwell, H. Higham, P. S. Hoyte, J. Harger Pye, H. E. Riley, C. Stapleton, A. Thomas, H. W. Versey, E. P. Vince, W. N. Westlake, and J. Wesley Whimster.
Representative on the General Committee in place of member retiring by rotation.—Mr. J. Armstrong.
Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. W. E. Dean, P. S. Hoyte, R. Robertson, and W. N. Westlake.
Representative on the Council of the British Road Tar Association.—Mr. W. N. Westlake.

RE-ELECTION OF HON. AUDITORS.

On the motion of Mr. J. TAYLOR (Weston-super-Mare), seconded by Mr. B. A. CARPENTER (Sheerness), Messrs. James Donaldson and John Urquhart were re-elected Hon. Auditors.

RE-ELECTION OF HON. SECRETARY.

The PRESIDENT, proposing the re-election of Mr. H. C. Smith as Hon. Secretary, said that during his own year of office he had been brought very closely into contact with Mr. Smith, and he was sure the Association could not obtain a better man for the office. Mr. Smith had held the position for three years; and it would be impossible to speak too highly of his qualifications for it. The successful work of the Association was very largely due to his efforts.

Mr. DOUGLAS HELPS, who seconded, agreed that the Association could not have a more capable man for the office.

The motion was carried unanimously, and Mr. SMITH briefly responded.

ELECTION OF SIR DAVID MILNE-WATSON AS HON. MEMBER.

The PRESIDENT moved that Sir David Milne-Watson, LL.D., D.L., be elected an Honorary Member of the Association, on the recommendation of the General Committee. He said that, when Mr. C. H. Rutter had made the suggestion that Sir David should be asked to become an Hon. Member, the suggestion was received by the General Committee with acclamation. It was unnecessary to say anything to the members of the Association by way of justifying the recommendation. Sir David's positions as Chairman of the National Gas Council, Chairman of the Federation of Gas Employers, and Governor of the largest gas undertaking in this country, were sufficient in themselves to justify the proposal, without any reference at all to his personal qualifications, by reason of which qualifications he had gained the unique position he now held in the industry. During the years in which he had been so prominently occupied with the work of the industry, its importance and value had been more generally recognized; and its prestige in the country had never stood so high as it did to-day. There was no one, either inside or outside the industry, who was so deserving of any honour that the Association could confer, and Sir David's acceptance of Honorary Membership, on the other hand, would confer honour on the Association and the greatest gratification upon its members.

Mr. C. H. RUTTER (Brighton and Hove General Gas Company), seconding, said he felt it a great honour to be allowed to do so.

The motion was carried with acclamation.

Sir DAVID MILNE-WATSON thanked the members very heartily indeed for the new honour they had bestowed upon him. He appreciated it all the more because it was bestowed by a technical body; for he was non-technical, and had never tried to pose as an authority on technical matters connected with this great industry. In that way, he believed, he had gained a great deal of strength. [Laughter.] He had certainly saved himself a vast amount of criticism. The fact that he had been elected an honorary member of a technical body showed, at any rate, that his work on the commercial side had been appreciated by his technical colleagues and friends, inasmuch as he had not put any obstruction in the way of their development. Among the honours which had fallen to his lot since he had been connected with the gas industry, this was by no means the least; and it was one which he assured them he appreciated very highly—especially after the manner in which it had been put forward by the President and Mr. Rutter.

NEW ORDINARY MEMBERS.

On the proposal of the PRESIDENT, seconded by Mr. C. V. BENNETT, the following were elected members of the Association:

Mr. George James William Anderson, South Metropolitan Gas Company.
Mr. David Craig Bertram, Gas Light and Coke Company.
Mr. Percy Cyril Gardiner, Tottenham.
Mr. William Hawkyard, Tottenham.
Mr. William Corbitt Kimpster, Bishop's Stortford.
Mr. H. Adolph Madsen, Gas Light and Coke Company.
Mr. Jeptha Neath, Gas Light and Coke Company.
Mr. Edward Samuel, Totnes.
Mr. Charles Stuart Shapley, Leeds.
Mr. Robert Edward Taylor, Haslemere.
Mr. Louis Frederick Tooth, Commercial Gas Company.
Mr. Percy John Kendall, Midhurst.

PRESENTATION OF CERTIFICATES.

The PRESIDENT then presented certificates to the successful candidates in the Higher Grade Examinations in Gas Engineering and Gas Supply of the Institution of Gas Engineers. He was glad, he said, that there had been a very large increase in the number of those resident in the Association's area who had obtained certificates this year. Whereas last year there

were only two or three successful candidates in the area, this year there were no less than fifteen. The successful candidates were:

Gas Engineering.

Mr. F. G. Pyper	First Class
Mr. J. A. Seabrook	" "
Mr. R. B. Tunstall	" "
Mr. E. E. Baker	Second Class
Mr. R. J. Pepper	" "
Mr. F. W. Sansom	" "
Mr. E. F. Stephens	" "
Mr. W. Storey	" "

Gas Supply.

Mr. R. N. LeFevre	First Class
Mr. L. C. Stevens Poulter	" "
Mr. J. H. Goldsmith	Second Class
Mr. F. Graham	" "
Mr. W. A. Hazeldine	" "
Mr. W. J. Mann	" "
Mr. G. W. Sutherland	" "

AMENDMENTS TO RULES.

The PRESIDENT proposed the adoption of the amendment to Rules 2 and 3, governing membership of the Association, as recommended by the General Committee. For some years, he said, the Committee had had under consideration the revision of the rules to enable men not engaged in the manufacture and distribution of gas, but whose technical qualifications were such as would make them useful members of the Association, to be eligible as members; and the result of their long and mature consideration of the subject was embodied in a carefully worded amendment. The Committee were very jealous of the standing which the Association held among associations of its kind, and would propose nothing which in their opinion would result in any depreciation of their high position; neither would they propose anything which would result in any reduction in the value of membership. The slight widening which the amendment would make in the entrance to the Association was so carefully guarded that it would certainly not result in any very great increase in numbers, or hurt the susceptibilities of the most conservative and exclusive of the members; but it would open the door to some who, if they would accept the implied offer of membership, would be a distinct acquisition to the Association. The only criticism, in his opinion, which might arise was as to whether the Committee had gone far enough; but unanimity was a great thing—on this subject particularly—to achieve. The proposed amendment was put before the members with the unanimous recommendation of the Committee; and he strongly supported the Committee. He formally proposed that the rules be amended as follows:

RULE 2.—By the addition of:

In addition, the Committee may recommend as associates those engaged in any responsible technical position (but who are not engaged directly in the manufacture or distribution of town's gas) whose experience is such as, in the opinion of the Committee, would be likely to be of advantage to the Association, and who, in addition, are either members or associate members of the Institution of Civil Engineers, or are in possession of a B.Sc. Degree of any British University, or other equivalent scientific or engineering degree.

Associates will not be eligible to serve in any office of the Association, and will not possess voting powers. They will be eligible to attend the Commercial Meetings of the District Sections only by invitation of the District Committees.

Mr. A. E. BROADBERRY seconded the proposal, and expressed the view that the General Committee were wise in having put it forward. He appreciated, as most of the old members appreciated, the great work the Association had carried on in the past; but he was sure they all felt that the developments which had taken place called for changes, and that notwithstanding all the good work that had been done by the Association during the last 52 years the hard-and-fast rules laid down at the beginning were now really obsolete. The time for restricted circles governing the membership had gone by. Restriction meant simply living on their own intelligence, without any assistance from outside, and tended to cripple expansion, not only in the Association, but in the industry itself. Outside the ranks of the Association as defined by the rules there were men of very good attainments, who he was sure would be very glad to lend their help in the further development of the industry. There were many men of technical and scientific ability who might be very helpful to the Association, and would be willing to help. The time had come when the Association wanted to draw on every source of help that it possibly could; and he felt sure that, by the adoption of the proposed amendment, the members would be doing something to swell the tide of knowledge and usefulness to the industry and to the country at large.

The resolution was carried unanimously.

WELCOME TO THE PRESIDENT OF THE INSTITUTION.

The PRESIDENT expressed gratification that Mr. H. D. Madden, the President of the Institution of Gas Engineers, was present. The members were pleased to welcome him.

Mr. MADDEN said that, although he had been asked repeatedly to attend the meetings of the Southern Association, wherein he had so many friends, it had never before been his good fortune to be able to do so, and it was a great pleasure to him to be there that day. He referred to the amendment to the rules as a wise and a good move—particularly as the Association was safeguarded by specifying that associates must be members or associate members of the Institution of Civil Engineers, or in possession of a B.Sc. or equivalent Degree. Even if those men were working for contracting firms, it was wise to bring them into the ranks of the Association. The Council of the Institution of Gas Engineers were working to broaden its basis. A Sub-Committee had been appointed to frame the rules and make every safeguard. There were men such as Mr. W. Doig Gibb on that Sub-Committee, to make sure that everything was carefully safeguarded; and he could say without breaking confidence that the rules as put forward—with which the Secretary of the Association, Mr. Smith, had had a great deal to do—were adopted by the Council of the Institution unanimously.

PARTIAL DRYING OF TOWN GAS.

Mr. C. Harris, of Taunton, then read a paper bearing this title, which, together with the discussion, appears elsewhere in this issue.

"NOTES ON HORIZONTAL SETTINGS, WITH SPECIAL REFERENCE TO SILICA RETORTS."

Mr. Stephen Hay, of Beckton, contributed a paper on this subject; but owing to lack of time, the discussion was postponed until the next meeting. An instalment of this paper is published on another page.

VOTE OF THANKS TO THE AUTHORS.

The PRESIDENT, proposing a vote of thanks to the authors of the papers, said they had provided an illustration of the advantages of both large and small undertakings to the Association. It would be invidious to make any comparison between the papers, but the members had benefited as much from the information given by the small undertaking as from that given by the larger one.

Mr. CARMICHAEL seconded the vote of thanks. Reverting to the question of the "Dri-gas" process, he reminded those members who contemplated its installation not to forget the consumers in their districts who were using the old-fashioned water-slide chandeliers. It was surprising to find how many still existed; and he urged gas undertakers to scrap them, and to instal the fixed type, even at their own expense.

The vote of thanks was carried with acclamation.

VOTE OF THANKS TO THE PRESIDENT.

On the motion of Mr. SAMUEL GLOVER, a vote of thanks was accorded the President for his conduct of the meeting; and appreciation of the care with which the programme had been prepared and carried out was also expressed.

The meeting then terminated.

CO-ORDINATING INDUSTRY WITH SCIENCE.

In the course of his Presidential Address to the Institution of Mechanical Engineers, delivered on Friday, Oct. 21, Sir Henry Fowler, K.B.E., LL.D., said that one of the signs of the times is the employment by practically all the steel and metal makers of metallurgists and metallurgical chemists, who are engaged on research. The progress which has been, and is being, made has been due to research, even if it has not always been recognized by that name. The work accomplished by individual firms is not only helpful, but absolutely necessary; for one can then freely deal with the products of the firm and the conditions under which they are employed. There is, however, the larger question of general research; and if the greatest possible progress is to be made in the future, it is necessary that this should continue on a still larger scale. Several of the larger firms have research departments. The National Physical Laboratory is probably the finest general research institution in the world. Many of the university laboratories are engaged on special work. Yet, in spite of this, one feels that research receives far greater attention in America and Germany.

Valuable as researches are when conducted on these lines, the President feels that research of the kind that is conducted jointly by scientists and practical men should receive more attention than it does at present. It is under such conditions that a wide view may be taken, and that the whole issue can be dealt with on the broadest possible basis. The British Non-Ferrous Metals Research Association and the British Cast-Iron Research Association, largely composed of and supported by manufacturers of the metals they deal with, and by engineers who use such products, are doing valuable work, but their activities are not so great as they deserve to be, owing to their not receiving the full support of the industry. The research worker is the pioneer, often working in practically unknown lands, and with little to guide him; and he must himself frequently be discouraged by not making the progress he desires. He is the explorer finding the path along which others may progress.

SOCIETY OF BRITISH GAS INDUSTRIES.

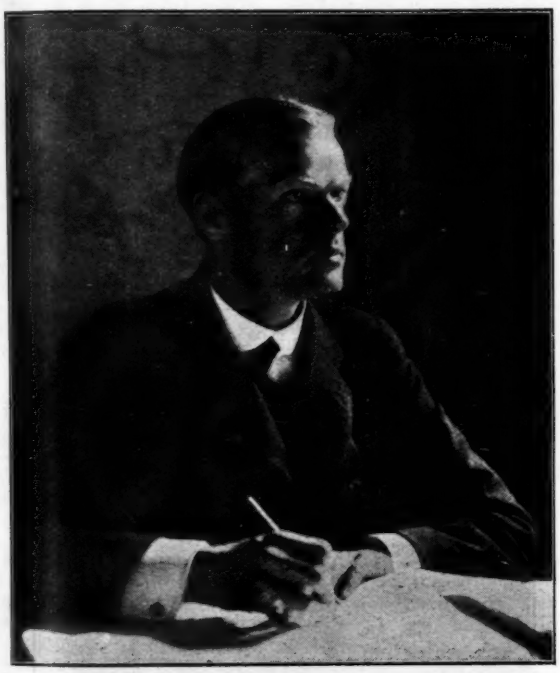
AUTUMN GENERAL MEETING.

The Autumn General Meeting of the Society was held last Thursday, at the Hotel Cecil, Strand, London, W.C. The business proceedings were preceded by a luncheon, at which the DUKE OF SUTHERLAND (the President) occupied the chair. By his side sat Mr. R. B. Hodgson (Chairman of the Council); and with them at the top table were Lord Riddell, Sir David Milne-Watson, LL.D., D.L., Sir Dugald Clerk, K.B.E., F.R.S., Sir Arthur Duckham, K.C.B., M.Inst.C.E., Mr. R. J. Milbourne, J.P., Mr. Eustace Abel Smith, J.P., Prof. Arthur Smithells, C.M.G., F.R.S., Alderman George Clark, J.P., Mr. B. B. Waller, Mr. Frederick J. Gould, Mr. Cyril G. Davis, Mr. Charles Clare, Mr. Samuel Cutler, Mr. Frederick C. Tilley, Mr. H. M. Thornton, J.P., Mr. P. F. Holmes, J.P., and Mr. Arthur L. Griffith (Secretary).

A short time was devoted to speech-making at the conclusion of the luncheon. The Loyal Toast having been honoured,

THE PRESIDENT.

Mr. R. B. HODGSON, as Chairman of the Council, submitted the toast of the President, his Grace the Duke of Sutherland. He remarked that the Society since its inception had been happy in its choice of Presidents, but never more so than on the present occasion. ["Hear, hear."] Though in many walks of life his Grace was a busy man, yet when the Council approached him with the suggestion that he should take up this office—which on the surface might appear to be a lighter one than actually was the case—he readily consented; and since taking on the Presidency he had always been most diligent in helping the Society in any way in which he had been called upon to help. The Society had been honoured by having as President many



HIS GRACE THE DUKE OF SUTHERLAND,
President of the Society of British Gas Industries.

distinguished men; and looking over the 22 years, he found there had been among them scientists who had made their name both in this country and in others; there had been great industrialists, who had taken a keen interest in their concerns; there had been some of the greatest lawyers of this generation; and, in the person of their respected guest Lord Riddell, there had been a representative of the Press. As a Society, they were engaged in many branches of industry—engineering, the manufacture of iron and steel pipes, the selling of coal for the production of gas, and the marketing of industrial and domestic apparatus—and he felt he was justified in claiming that it was an organization which really did count in the industry of the country.

INCREASING SPIRIT OF CO-OPERATION

The DUKE OF SUTHERLAND thanked those present for the cordial manner in which they had received the toast, and Mr. Hodgson for the kind words with which he had proposed it. He regarded it as a great honour to be allowed to become their President; and he would always look back upon his year of office with pleasure and happy remembrances. There was no need for him that day, in the very brief time they had at disposal, to review the activities of the gas industry during the past year; but one thing which interested him greatly was to see the increasing spirit of co-operation in the industry between employers and employed. He was convinced that this better feeling was the only path to economic reconstruction of the country, and to the restoration of prosperity. He was himself looking forward to the time when every worker in industry would have an indirect, as well as a direct, interest in his job, by holding shares in it and drawing dividends, or by some similar method. Sir Alfred Mond had already done this with regard to Imperial Chemical Industries. The more people could extend these schemes, the better, in his opinion, would it be for industry in general. It would increase the sense of responsibility among all classes concerned in the conduct of industry.

COAL INDUSTRY AND "TRUSTIFICATION."

While he was on this subject, he would like also to say a few words on an allied subject. It had to do with an industry with which the gas industry was closely concerned—namely, coal mining. The coal industry, as, of course, all those present knew, was largely dependent upon, and bound-up with, the iron and steel industries of this country; and it could never prosper until there was a satisfactory revival in the iron and steel trades. Proposals had recently been put forward for the "trustification" of the coal mining industry. The proposals, in brief, were that the whole coal mining, coal distributing, and coal exporting industry of the country should be united in a single economic organization. It was claimed that by this method the coal industry could again be put upon a paying basis, and secure and constant work be found for miners. It was useless to pretend that the coal situation was such that nothing required to be done. On the contrary, as they all knew, the situation was a most unsatisfactory one in certain respects. Mines in great areas were losing money, and unemployment was rife among the miners. The word "Trust" was an unpopular one in this country. He thought it was bad policy to choose this name for whatever scheme might be put forward as a possible source of amelioration for this great staple industry. However, this did not affect the merits or demerits of the proposals; nor was it for him to express an opinion on the suggestions, one way or another. But he really believed that the proposals were conceived as much in the interests of the coal owners as of the coal users. He felt, therefore, that it would perhaps be right that the coal owners should investigate the scheme on its merits, and let people know their considered views. Possibly, too, those in the gas industry, who were great experts in these matters, and who were closely involved in the coal situation, would examine the proposals, and set-out their opinions. The state of the coal industry in this country was not such that the door should be closed to any expert plan put forward to improve it, and, by improving it, to sweeten relations between employers and employed, both in the coal mining and in the great allied industries.

PROTECTION AGAINST DISADVANTAGEOUS LEGISLATION.

Mr. R. J. MILBOURNE proposed the next toast, which was that of the Vice-Presidents of the Society. It was, to his mind, a remarkable thing that more than one-half of the distinguished men who had filled the office of President should have honoured the Society by accepting the invitation to join them that day, and should continue to give the organization their support and assistance. At the present time, when so many politicians and lay journalists and others were proposing and offering and promising to give cheap electricity in all parts of the country, it was necessary that they, as a Society who represented such a great industry as gas, should have as much support as possible from those outside their business, in order to protect the industry against any disadvantageous legislation which might be proposed by the Government to the detriment of gas. Therefore it was advisable—and it was a great asset—for the Society to retain the assistance of the Past-Presidents, who could put their case clearly before both the politicians and the journalists. He was going to couple with the toast the name of Lord Riddell, who, he thought, would almost alone be capable of instructing both the politicians and the lay journalists in the advantages of gas, and of seeing that the gas industry was not penalized or placed in any unfair competition with its rival electricity.

THE PROGRESSIVE AND ENERGETIC GAS INDUSTRY.

Lord RIDDELL, responding, said he felt flattered by the kind words in which Mr. Milbourne had proposed the toast, although he was somewhat mystified by the statement that he alone would be able sufficiently to indicate the advantages of gas. What was implied in this remark, he could not tell. [Laughter.] He was also interested in what had been said about the abandonment by the politicians of the gas industry for the electrical industry; but here, again, he did not exactly know what the remark implied. He was bound to confess that he regarded the gas industry as one of the most progressive and energetic industries of the country. This industry was another instance of the advantages of adversity and competition. Faced with severe competition, the gas industry had pulled itself together, and in a most extraordinary fashion had resuscitated itself, and had extended its influence and its usefulness, so that to-day it was one of the most prosperous industries in the country. He, however, liked the gas industry for another reason. It was, as he had said just now, an enterprising industry—a modern industry, full of new ideas. It was one of the industries that had perceived the importance of advertising. [Laughter.] It had set-up a most powerful organization for the purpose of making use of advertising in the Press and elsewhere. Well, the result was what they saw. His experience was that the gas industry was so popular and so prosperous that it continually disported itself with great dinners and luncheons; and he was told that even the humblest member of it drove a Rolls-Royce car. [Laughter.] This showed the advantage of producing a good article, marketing it efficiently, and advertising it properly. But, quite seriously, he

thought their industry set a very good example to other industries in the country; and, as a detached observer, he would like to say that if all the industries had adopted the modern methods adopted by the gas industry, trade generally would be far more prosperous than was the case at the present time.

TROUBLES MAINLY DUE TO NEW CONDITIONS.

If he might say so, the Duke of Sutherland had made a most statesmanlike speech. ["Hear, hear."] He had not expected to hear a subject of that sort discussed at this luncheon. He listened with much attention to what the Duke said; and he said some very useful things. However, just before the Duke spoke, he (Lord Riddell) had had the advantage of a little conversation with their first President, Sir Dugald Clerk—one of those modest, retiring scientists who had done so much to make the trade and industry of Britain. He had said to Sir Dugald that the causes of depression in the coal trade were fundamental. Owing to the bad condition of the iron and steel trade, the coal trade had lost one of its best customers. Being in the journalistic business, and always anxious to obtain information, he put forward a feeler. He said: "So far as one can see, a safeguarding tariff is necessary to enable the iron and steel trade to get on its feet again and become a great customer of the coal trade." In reply to this suggestion, Sir Dugald Clerk said: "Be careful. If you protect the iron and steel trade, God knows what will become of us engineers engaged in the gas industry, who rely for lower grades of steel on foreign imports." He was not agreeing or disagreeing with either Sir Dugald Clerk or the Duke of Sutherland; but he did think they were very much indebted to the latter for raising this question before such an important body as the Society of British Gas Industries. There was no doubt at all that the condition of the four staple trades of the country—coal, iron and steel, cotton, and wool—was a matter that demanded the most serious attention. It was customary, when referring to these subjects, for speakers to attribute the whole of the troubles to differences between capital and labour. This was not true. Their troubles were mainly due to new conditions in the world—to new competitors and new scientific developments, to changes which did not relate to any lack of combination between employers and employed. It was very bad that they should allow their minds to be diverted from these factors in such a way that they gave their sole consideration to questions of difference between capital and labour. The gas industry, if one examined it, was typical of many other great industries of this country. It was a mistake to imagine that Britain had been behindhand in invention and enterprise. It was, indeed, an absolute lie. Nearly all the great inventions of modern times had been made by Britons—and, he was going to say, most of them in Scotland. It was a real honour to respond to a toast which included Sir Dugald Clerk. It was to him, and to men like him, that they owed so much of what they possessed. The British gas engine held its own in all foreign countries. There was no country which, as manufacturers of gas engines, equalled Sir Dugald Clerk and others who were engaged here in that great industry. On behalf of the Vice-Presidents, he thanked them all for the manner in which the toast had been proposed and received.

BUSINESS MEETING.

The business meeting was afterwards held in the hotel—the DUKE OF SUTHERLAND (the President) in the chair.

The SECRETARY (Mr. Arthur L. Griffiths) had received apologies for absence from Lord Ednam, Sir Alfred Mond, Lord Merrivale, Sir Robert Hadfield, Lord Weir, Prof. Harold B. Dixon, Sir Guy Wrightson, and Alderman F. J. West.

Mr. R. B. HODGSON (Chairman of the Council) read the following:

Report of the Chairman of the Council.

It is customary at our Autumn General Meeting for the Chairman of the Council to give a short report on the Society's work during the past six months.

The period under review has been, for the majority of our members, a somewhat difficult and trying one. The various gas undertakings in the country have only begun to recover from the disaster of last year; and while it is satisfactory to know that gas consumption continues to increase, the buying of new plant has been somewhat retarded. The members of the Society in all its sections are alive to the difficulties obtaining, but are at the same time actively ready to meet all demands immediately "good times" arrive.

As a Society we have a membership of 136 firms engaged in every department of the manufacture of gas plant and appliances, and our ramifications in all branches are world-wide. We are satisfied we have both the plant to manufacture, and selling organizations able to meet the demands not only of the home trade, but for all export requirements; and we look forward with confidence to a continued increase in the output of gas and its products, so that there may be an increased demand for appliances and apparatus. In the engineering trade it is pleasing to note a feeling of better relationship between employers and employed; and we are hopeful that it may be possible to settle down whole-heartedly for some time, to work together on mutual and co-operative lines which will be beneficial to trade generally.

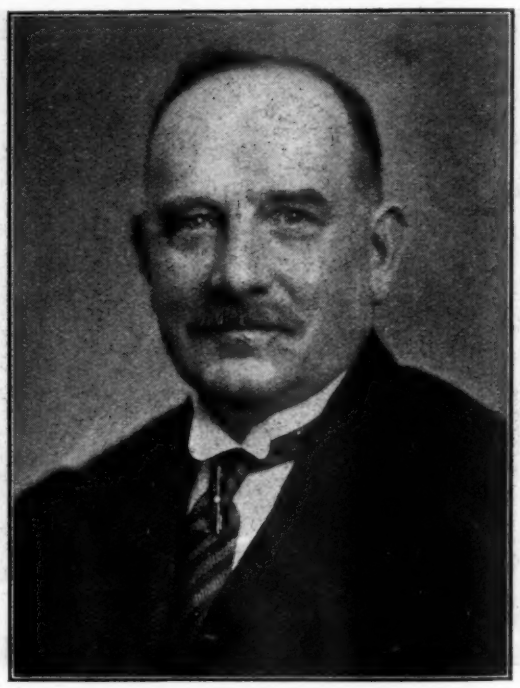
The year 1926, with its heart-breaks, has passed into history; and we feel confident that the lessons learned will help in the future to a wiser and saner industrial policy. Employment has been better for some months now in many of the staple industries of the country; and in an article in "The Times" lately it was stated: "It can be taken that industry generally is sounder than at any time since 1921." Let us hope that the gas industry may speedily share in any revival long deferred.

We are much indebted to our Past-President, Viscount Ednam, M.C., D.L., for his very able address at our annual meeting in May entitled "Cheaper Fuel—Some Ideas and Observations," which dealt largely with the coal question in this country, and touched upon the most vital points of that industry. The annual meeting was a very successful one, and at the dinner we were honoured by the presence of a number of distinguished guests.

We are fortunate on this occasion in having our new President, His Grace the Duke of Sutherland, in the Chair. To him we accord a very hearty welcome.

BRITISH INDUSTRIES FAIR, 1928.

After an official visit by the Chairman and Council to the British Industries Fair held in February last, it was felt that the Society should support the Fair next year, particularly in view of the fact that very few gas exhibits were in evidence on that occasion. In July last, through the kind offices of Mr. A. W. Smith, of the Birmingham Gas Department, a meeting was held in Birmingham, when it was decided to form a Gas Industries Section at the 1928 Fair. A small Sub-Committee was formed, comprising members of the Society, and representatives of the Fair and of the Birmingham Gas Department, to deal with the letting of space and the general co-ordination of the gas exhibits to be shown. Mr. R. J. Rogers was appointed as Hon. Secretary to the Gas Industries Section. A useful and attractive exhibit of appliances for heating, cooking, lighting, and industrial purposes will be presented to the overseas and home buyers, which we trust will be worthy of the gas industry. The National Gas Council, the Institution of Gas Engineers, and the British Commercial Gas Association have given their patronage to the Section.



R. B. HODGSON, M.I.MECH.E.,

Chairman of the Council of the Society of British Gas Industries, is Managing Director of the Whessoe Foundry and Engineering Company, Darlington. Previous to going to Darlington, he was a Director and General Manager of Messrs. Ashmore, Benson, Pease, & Co., Ltd., of Stockton-on-Tees. Before that he was General Manager of the Workington Bridge and Boiler Company. He is a member of the Iron and Steel Institute and of the Chartered Institute of Engineers, and is well known throughout the gas industry and the iron and steel industry. He is also a member of the Executive of the British Commercial Gas Association.

RETORT SETTERS.

A conference between Section 1 of the Society and the Amalgamated Union of Building Trade Workers was held in May, when a new agreement with certain modifications was amicably and satisfactorily settled.

NATIONAL ILLUMINATION COMMITTEE OF GREAT BRITAIN.

We have been invited to co-operate in the work of the National Illumination Committee, and have nominated two representatives to serve on the Committee.

INTERNATIONAL COMMISSION ON ILLUMINATION.

An important meeting of the International Commission on Illumination was held at Bellagio at the end of August, to

which we nominated representatives. The objects of the Commission (which originated from the congress of Gas Engineers held in Paris on the occasion of the Exposition of 1900) are to study questions connected with the art of illumination and of the sciences relating thereto, and to establish by suitable means international agreement on such questions.

The achievements of the Commission have had a far-reaching effect, but there is a great deal more to be done. The first steps have been taken, and the work of establishing bases for the comparison of light, natural and artificial, and for all apparatus, industrial and scientific, making use of it or being used for its transmission or reflection is of the highest importance.

In addition the Commission provides the only effective channel for the international interchange of knowledge; and its effective use by those engaged in the sciences and arts associated with light and illumination will, by co-ordination, prevent a vast expenditure of time and money on experimental effort by the industries in every country.

Standard Specification for Street Lighting.

We were represented on the Committee of the British Engineering Standards Association which drew up the British Standard Specification for Street Lighting; and this has now been adopted and issued.

Refractories.

An important meeting of the Refractory Materials Joint Committee was held in the early part of the year to consider the revision of the Standard Specification of Refractory Materials as relating to the gas industry. Drastic alterations were proposed, and after a lengthy discussion it was decided, as there was such a diversity of opinion, to refer the matter to the British Refractories Research Association for investigation, so that the matter could be brought forward again for decision at a future meeting.

Two meetings of the Refractory Section of the Ceramic Society, of which most of Section 10 are members, have taken place during the year. In May the Society paid a visit to Czecho-Slovakia and Austria under the Chairmanship of Mr. Frank West, M.I.Mech.E., and there inspected a large number of works manufacturing refractories of all kinds. There was a good attendance, and the visits and meetings were very successful. The autumn meetings of the Society were held at Bournemouth in September under the Presidency of Mr. H. J. C. Johnston, of the Leeds Fireclay Company. At these meetings several very important papers were read and discussed. The members also visited several works in the district.

Gas Coal Section.

With regard to Section 14, nothing of great importance has arisen during the period under review. There have been one or two meetings of the Section, when general questions interesting to the gas coal trade have been discussed. It is hoped that the membership of the Section will shortly be increased.

Gas Fire Flues.

Reference was made to this question in the annual report. At the recent annual conference of the British Commercial Gas Association, the Executive Chairman presented a report of the Executive Committee on the tendency observable in some parts of the country to construct houses without flues of any kind. He stated that the Ministry of Health had been approached on the matter, and that as a result the Ministry was conducting tests in specially constructed chambers. The outcome of these tests will be awaited with interest. Meanwhile, one of our members is carrying out extensive propaganda against flueless rooms or inadequate flues for gas fires, by promoting the use of special concrete gas flue blocks. Considerable savings in building costs result from the use of these blocks instead of the ordinary brick chimney, which is an inducement to the builder who is tempted to leave out flues entirely in some rooms, on the score of economy; and as a result thousands of living-rooms to-day are fitted with gas fires which would not have been otherwise. It is further of interest to note that these flues, while of adequate dimensions to carry away the products from a gas fire, are not suitable for a coal fire. Hence, in buildings where they are adopted, the permanent use of gas for heating is practically assured—at least it can never be replaced by coal.

Conference on Methods of Analysis of Coal.

We were represented at an important conference held in October convened by the British Engineering Standards Association in response to an official request from the Committee of the Privy Council on Scientific and Industrial Research, when the question of the adoption of Report No. 7, "Methods of Analysis of Coal," as drawn up by the Fuel Research Board, was considered. The conference unanimously decided that the British Engineering Standards Association should set up a representative Committee to go into the question and make recommendations for the commercial analysis and sampling of coal.

Revision of Railway Classification of Goods.

Messrs. Tweedy & Holt, our Railway Experts at Halifax, continue to watch our interests; and their reports keep us in touch with railway matters.

The prizes in the City and Guilds of London Institute Examinations in Gas-Works Practice, Gas Supply Practice, and Gas Fitting have been duly awarded, and announced in the Technical Press. The Institute state they are confident that the award of these prizes is an incentive to serious study on the part of their candidates; and from communications we have received it is gratifying to know that the prizes are much appreciated by the recipients.

We are pleased to report that the membership is steadily increasing, and that the Coal Section and the Tube and Pipe Section recently formed have added materially to the utility of the Society. Both sections are now in active operation.

Mr. Hodgson, in moving the adoption of the report, said he would like, in a word or two, to supplement some of the points raised in it. It was stated in the beginning that the period under review, as far as engineering was concerned, had been difficult and trying. In the heavier trades—in coal and steel—this was only too true. In the lighter sections, things, he believed, had been more normal. The coal stoppage twelve months ago was a serious set-back to progress in the renewal of existing plants and the placing of orders for long-delayed extensions; and as a consequence, the heavy trades suffered. To all industries affected by coal, steel, and engineering, this applied; and unemployment during the latter part of last year and the early months of this year was on the increase. But the figures for recent months bore a most hopeful character, and indicated a better state of things. They looked forward for this next year to a bigger expansion of the gas industry; and just as their electrical friends were forging ahead with all sail set, so must the gas industry, with all the resources at its disposal, keep pace, and not be left behind. In connection with the British Industries Fair at Birmingham in 1928, might he emphasize the necessity for making this worthy of the industry? On the last occasion the gas industry left the thing alone; and this was manifest to all who attended. Again, their electrical friends were in front, and made the best of their exhibits. This time the gas industry had taken up the matter more seriously; and it was hoped that the exhibits of appliances for heating, cooking, lighting, &c., would be such that their particular industry would be stimulated thereby, and that the exhibition, from their point of view, might be a brilliant success. The Society generally had endeavoured during the past six months to keep in touch with all conditions affecting the welfare of its members and the industries it represented. Each Section had been alive to the needs of its members. Topics both commercial and technical had been considered from time to time, and encouragement lent to every subject bearing upon the welfare or advancement of the interests of the various Sections.

Mr. R. J. Milbourne seconded the adoption of the report, and this was unanimously agreed to.

The Romance of the Gasholder.

Mr. Hodgson then delivered an address entitled "The Romance of the Gasholder." This, together with a report of the long discussion which followed it, will be found elsewhere in this issue.

Vote of Thanks to the President.

Before separating, a hearty vote of thanks was passed to the President, on the proposition of the Chairman, who acknowledged the indebtedness of the Society to the Duke of Sutherland for having attended the meeting.

Value of Light and Heat in Medicine, Surgery, and Hygiene.—Sir Alfred Mond will open the first International Exhibition on Light and Heat in Medicine, Surgery, and Hygiene, which will be held at the Central Hall, Westminster, Dec. 13 to 16 inclusive. There will be a conference in connection with the exhibition, at which medical and scientific men will discuss a number of questions arising out of the new methods of healing which have for their basis the use of light rays, ultra-violet rays, heat rays, and X-rays. Exhibition space will be devoted to a comprehensive display of heat, light, and ultra-violet ("artificial sunlight") lamps, and certain drugs and preparations which are now used conjointly with the rays. A paper is to be read by Prof. Leonard Hill, F.R.S., Director of the Department of Applied Physiology at the Medical Research Council's laboratory at Mount Vernon. Among those who will preside at the sessions is Sir Henry Gauvain, M.D., M.C. The exhibition and conference have been organized by the "British Journal of Actinotherapy," 17, Featherstone Buildings, London, W.C.1, to which address those who wish to attend should make application.

COMMERCIAL MOTOR TRANSPORT.

International Exhibition at Olympia.

All railway officials in authority, as well as all whose business calls for either heavy or light haulage work, should make a special point of visiting Olympia during the run of the Eighth International Commercial Motor Transport Exhibition, which closes next Saturday, Nov. 26. Glancing over the last few years, one cannot fail to be deeply impressed by the progress that has been made in the design of motor propelled vehicles; while to those whose memories carry them farther back, a tour of Olympia must prove still more amazing. What is to be seen there, taken in conjunction with the recent display of modern road making methods at the Agricultural Hall (an account of which will be found in other columns of this issue), should convince even the most conservative of the ever-increasing efficiency of the modern means of transport.

This year the outstanding features are six-cylindered engines and six-wheeled chassis—both, it is claimed, factors tending to economy, reliability, and comfort. Vehicles have been specially designed for the carriage of all kinds of goods, both solid and liquid; and many of those shown bear the names of the firms, and an indication of the class of work, for which they are destined. The casual visitor will, however, in all probability be most struck by the size and luxuriousness of some of the passenger vehicles exhibited. The adoption of six wheels for double-deck omnibuses permits of the construction of these vehicles to carry some 70 passengers. There is, indeed, a striking exhibit by Associated Daimler of a 68 seater six-wheel, all-metal body omnibus, the price of which complete is £3000. Some of the saloon coaches constructed for fast long-distance travel leave nothing to be desired in the way of luxury; and there is even an observation saloon coach, for the benefit of tourists, who, from substantially raised rear seats can enjoy a better view of the scenery than is possible from the usual low level.

A six-wheeled chassis is also employed for a 1500 gallon welded elliptical rigid tank, with all the latest means for handling motor spirit in bulk. The makers of this are Messrs. Thompson Bros. (Bilston), Ltd. This is to mention only one instance out of a great number of specialized vehicles. How the industry has grown will be gathered from the statement that, as against a total of 140,000 commercial goods and passenger vehicles in use in this country in 1920, the number is now, according to Ministry of Transport returns, little short of 400,000.

Among miscellaneous exhibits, it is to be noted that the National Benzole Company, Ltd., of Wellington House, Buckingham Gate, London, S.W., draw attention to the guaranteed British motor spirit—"National Benzole Mixture" and "National Benzole"—and also "N.B.C." lubricating oils and greases. Kasenit Ltd., of Henry Street, Bermondsey Street, London, S.E., show a gas-fired furnace which has been designed to meet the various demands for heat-treatment in modern garages. The burners are arranged beneath the bottom of the furnace; the burner body being of malleable iron, and having a cone-shaped air injector provided with a sliding hit-and-miss device for securing correct adjustment and control of the mixture.

MANY STEAM VEHICLES ON VIEW.

There is a very good show of steam-driven vehicles, though an even more valuable display (from the point of view of demonstrating the general utility and efficiency of this class) was provided by a tour by a number of steam wagons of the industrial North and the Midlands to Olympia—a start being made from Liverpool. In connection with this, Mr. T. Molyneux (of the Liverpool City Engineer's Department) is quoted by the "Commercial Motor" as having said that "the turnout of such smart, efficient, and representative types of vehicle enabled one to measure the enormous progress which had been made in steam-vehicle design."

Readers who are interested in the use of coke for steam raising for this purpose, will find a number of stands that call for their attention at Olympia. To name some of them, there are those of Clayton Wagons, Ltd., of Abbey Works, Lincoln; Fodens, Ltd., of Elworth Works, Sandbach; Messrs. Richard Garrett & Sons, Ltd., Leiston Works, Leiston; the "Sentinel" Waggon Works, Ltd., of Shrewsbury; and the Yorkshire Patent Steam Wagon Company, of Vulcan Works, Pepper Road, Hunslet, Leeds.

"SENTINEL" HIGH-SPEED HEAVY TRANSPORT.

The Model "D.G. 6" of the "Sentinel" Waggon Works, Ltd., is a rigid bogie-type six wheeler, the construction of which includes a number of original features, as the result of an effort to provide a high-speed 15-ton capacity lorry; and it is claimed by the designers that it is likely to set-up some new heavy transport standards. A few of the special points are: Roller bearings of stainless steel; steam braking of four wheels; eddie-eliminating, stream-line steam passages, ensuring added power; oil circulation to maintain gearbox and crankcase oil cool and at its optimum quality; steam pressures at 275 lbs.; and four wheels pivoting about one hollow tapered axle.

This new vehicle, in tests at Shrewsbury, has carried 15 tons 19 miles on a consumption of 1 cwt. of coal and about a pint of oil. From 12 M.P.H., it can be stopped-dead in 22 ft. on a wet road, without any sign of skidding, and with a load of 15 tons. It will turn in a 62 ft. circle. Chain drive has been adopted. The aluminium and alloy-steel engine actually gives an efficiency of 16 lbs. of steam consumed per B.H.P. hour. It is capable of a maximum of 90 B.H.P.

The examples on the stand include a large wagon for the coke trade of the Gas Light and Coke Company.

"YORKSHIRE" TYPE.

The Yorkshire Patent Steam Wagon Company have two exhibits—one of them a 6-ton "Yorkshire" wagon with flat lorry body, and the other a chassis arranged to display all components and working parts. It has a double-ended loco-type boiler, mounted transversely at the front, so that even on the steepest hills the tubes and fire box are never uncovered. A tank capacity of 190 gallons is provided; and this is sufficient for a run of 35 to 40 miles on good roads. It may be added that 8 cwt. of fuel can be carried in the bunker.

One of the main objects in the design of this vehicle has been to provide a wagon which will be suitable both for long-distance road work and for heavy haulage.

FUEL RESEARCH AT THE SHEFFIELD UNIVERSITY.

The "Western Mail" has of late been devoting itself to coal questions very seriously, stimulated probably by the conditions existing in its regional coalfields. Among contributions to its columns is an article by a "Special Correspondent," which gives an account of the fuel research work that is proceeding at the Sheffield University, under the direction of Prof. R. V. Wheeler, D.Sc., and his chief assistant, Mr. R. A. Mott, M.Sc. The article is directed generally to assist in disproving the allegation that in this country we are behind others in the matter of research; and the work in fuel research at Sheffield is taken as illustrating our activities.

Reference is made to the work which is going on in the production of liquid fuel from water gas. Prof. Wheeler and Mr. Mott, the article states, "have acted upon Fischer's method, and have produced methyl alcohol. Their aim is to obtain ethyl alcohol for use in internal combustion engines in such quantities and so cheaply that Britain no longer would be dependent upon foreign liquid fuel. If this great effort is brought to a successful issue—and the Sheffield scientists seem very hopeful—the bogey of fuel shortage (a thing that could cripple us in time of war) will be laid for ever. So far as the experiments have progressed, the main constituents of the liquid produced are steam, coke, and hydrogen. The steam is passed through metallurgical coke to produce water gas, to which, if necessary, hydrogen is added, and the combined gases pass into a catalyzing chamber where, with further chemical treatment, they are subjected to pressure at a high temperature. The result is a liquid which, it is hoped, will provide the eagerly sought fuel. To the present the mode of production is both simple and cheap; and there is every ground for optimism in regard to the eventual outcome of the process." In passing, the writer of the article states that it is interesting to note that the water-gas plant installed at the Sheffield University is the only erection of its kind in the country. This seems rather a curious statement to make, unless there is something special about its design of which we are not aware.

Mention is also made of the investigation which is proceeding at the University into the low-temperature carbonization of coal. After referring to other activities, there is allusion to the endeavour which is being made to discover the reasons for the variation in the constitution of coal, which knowledge is fundamentally important in fuel research work. Reference is made to the explorations of the South Yorkshire Survey Committee of the Fuel Research Board, and the efforts of the Midland Blast-Furnace Company Research Committee. The latter are seeking to discover a conclusive test for metallurgical coke for blast-furnaces and cupola steel practice. So far it has been determined that the Shotton test provides very good indication of the value of the coke for these particular needs.

PARTIAL DRYING OF TOWN GAS.

By C. HARRIS, of Taunton.

[Before the Southern Association of Gas Engineers and Managers, Nov. 16.]

The Company who are our largest consumers suffered considerable annoyance from the repeated presence of water, and to a lesser degree of naphthalene, in their gas mains and smaller supply pipes; and they eventually threatened that, unless these sources of complaint were removed, they would have to adopt alternative means of lighting. In the endeavour to eliminate the causes of the complaint, we first decided to adopt oil washing for the removal of naphthalene. We had already been vaporizing paraffin for some years, and had greatly reduced complaints by this means; but the more logical method was, of course, to reduce to a negligible amount the naphthalene in the gas sent out.

DEPOSITION OF WATER IN GAS MAINS.

The prevention of water deposition in the mains was a much more novel problem. There is little doubt that throughout the greater part of the year the average temperature of the gas leaving the holder is higher than that of the district mains; and this is conclusively proved by the deposition of water in the mains and services, which occurs throughout the whole of the year in most districts. A series of figures for temperatures in gas mains in the street was taken by J. W. Napier, of Alloa, Scotland, and are reproduced from "The Distribution of Gas," by W. Hole, in Table I. below:

TABLE I.

Month.	Maximum Deg. Fahr.	Minimum Deg. Fahr.	Average Deg. Fahr.
January	40	35	37
February	44	36	39
March	43	37	39
April	46	39	44
May	59	47	50
June	65	54	59
July	68	56	61
August	65	54	59
September	58	51	54
October	59	45	50
November	49	38	44
December	44	36	39

W. Hole has also shown that in Leeds, for the years 1908 to 1911 inclusive, the average temperature of the gas at the works distribution governor was 51° Fahr., while that in the mains was 45° Fahr. There is thus an average difference of 6° Fahr. between governor and mains, although it is probable that in the summer the actual difference is greater than 6° Fahr., and in the winter less. A plausible assumption would be that the difference was about 8° Fahr. in summer and about 4° Fahr. in winter, though one cannot be too dogmatic, as conditions will vary with local circumstances.

The gas can probably be regarded as nearly fully saturated with water vapour at the time of leaving the holder; and the subsequent cooling to the temperature of the mains must necessarily cause condensation of water vapour and deposition of water, which is found in the district mains and occasionally in the small service pipes.

AMOUNT OF WATER DEPOSITED.

The amount of water likely to be deposited under average temperature conditions throughout the year can be calculated from consideration of:

1. The respective temperatures at the holder and in the mains and services.
2. The water vapour content of gas saturated at these temperatures.
3. The output of gas.

In Table II. the amount of water deposited from 1 million c.ft. of gas has been calculated on the assumption that during the months of April to September the difference between the temperatures at the governor and in the mains was 8° Fahr., and was 4° Fahr. for the remaining six months, October to March, inclusive.

TABLE II.

Month.	Av. Temp. in Mains from Table I. Deg. Fahr.	Av. Temp. of District Governor. Deg. Fahr.	Moisture Content at Higher Temp. Grs. per C.Ft.	Moisture Content at Main Temp. Grs. per C.Ft.	Deposition in Mains. Grs. per C.Ft.	Deposition in Mains. Gals. per Million C.Ft.
January	37	41	2·84	2·43	0·41	5·9
February	39	43	3·07	2·62	0·45	6·4
March	39	43	3·07	2·62	0·45	6·4
April	44	52	4·32	3·19	1·13	16·1
May	50	58	5·4	4·01	1·39	19·9
June	59	67	7·45	5·59	1·86	26·6
July	61	69	8·00	6·01	1·98	28·3
August	59	67	7·45	5·59	1·86	26·6
September	54	62	6·24	4·66	1·58	22·6
October	50	54	4·66	4·01	0·65	9·3
November	44	48	3·72	3·19	0·53	7·6
December	39	43	3·07	2·62	0·45	6·4

Without generalizing too freely from the limited data available, the deposition of water in the gas mains is familiar to all gas engineers; and the amount of water deposited may vary between wide limits.

I am indebted to Mr. Robertson for the charts showing the air temperatures and temperatures 1 ft. and 2 ft. below the surface of the ground throughout the year at Bristol. One very interesting point brought out (for which the reason is obvious) is that the temperature of the ground lags behind the temperature of the air in summer, attaining its maximum some time after the air does; and similarly in winter the ground again shows a lag behind the air in cooling. The temperature of the air cannot be taken as that of the gas sent out; but it will show a fairly fixed relationship, and the curves explain why water may be deposited chiefly in the mains during one period of the year and largely in the services and exposed house pipes during the other portion of the year. During the winter it is quite possible, and very often happens, that the gas is warmed by passing through the mains, and picks-up moisture which it afterwards deposits in the more exposed pipes and services. During the summer, when the mains are relatively cooler, the deposition of moisture is chiefly in the mains.

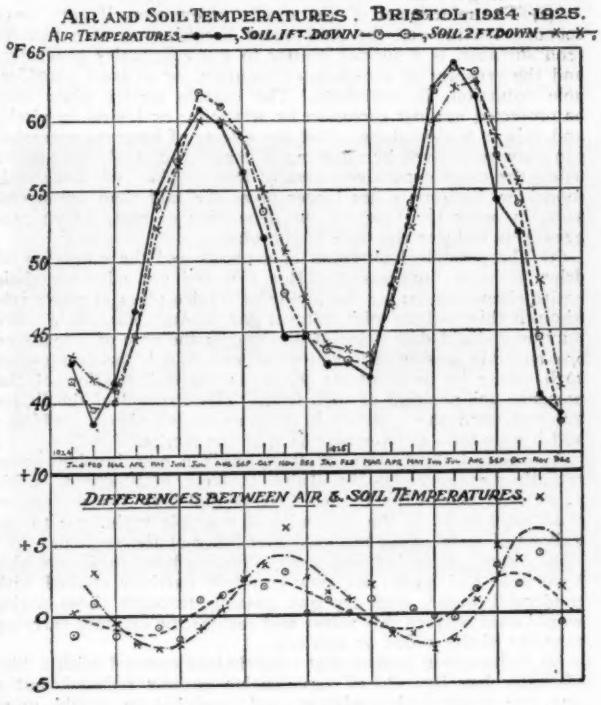


Fig. 1.

The same reasons and consequences apply to the deposition of naphthalene.

ADVANTAGES OF WATER REMOVAL.

On consideration, the advantages of moisture removal appeared to me to be very striking; and they are summarized as follows:

(1) Hitherto we had hesitated to adopt steel mains as our standard, though we had little doubt as to the freedom from rusting of these mains on the outside when well coated and wrapped. It was certain that the life would not be so long as that of cast-iron mains, because of the internal rusting which must occur eventually. With dry gas (combined with oil atomizing or oil vaporizing to give an internal film of oil), the life of steel mains should be indefinite; and, moreover, the carrying capacity of such mains would remain the same, as they would not become partially choked with rust or water.

Probably the most far-reaching effects of the deposition of water in mains arise from the corrosion set-up by constituents

of the coal gas—such as oxygen, carbon dioxide, hydrocyanic acid, and traces of ammonia in the presence of water.

In general, it may be considered established that corrosion of iron and steel mains is due to electrolytic action taking place in dilute aqueous solutions of such compounds as the above. Such action, being primarily dependent on the formation of solutions, apparently cannot take place if liquid water is not present. Therefore, the deposition of water in the main is to be regarded as the primary factor in corrosion, and the concentration of corrosive compounds as secondary.

This fact has long been recognized in boiler engineering practice with respect to the corrosion of economizers by SO_2 in the flue gases from the boiler. In order to prevent deposition of moisture from these gases, they are not cooled to their dew-point. The SO_2 thus passes round the economizer tubes, but in the absence of liquid water has no corrosive action.

Steel plates on which ammonium thiocyanate solution has been placed are exhibited; and it will be seen that, while the corrosion is extensive in moist gas, it is less in slightly unsaturated gas, and in dry gas no corrosion whatever occurs.

(2) The replacement of gas service pipes—even if only every 20 or 30 years—and the subsequent breaking-up of expensive road surfaces, is a serious matter to gas companies generally; and the prospect of complete elimination, or at least considerable reduction, is attractive. The outside service pipes may be protected against corrosion by wrapping or laying in pitch; and this is widely done. But the effects of internal corrosion can only be delayed by adopting a heavy gauge of pipe and/or using the more expensive wrought iron in place of steel; and, moreover, in some cases larger pipes are laid than are necessary, in order to allow for the deposition of rust, which progressively reduces the bore of the pipe.

(3) The periodical pumping of syphons and the emptying of drips becomes unnecessary. But I would not advocate their entire abandonment, or the laying of service pipes at any angle (though this is done with natural gas in America), since there may be a slight deposition of oil; and in the case of a leaky or broken main or service in water-logged ground, the presence of such water in the syphons gives an early indication of the presence and position of such leak. The disposal of the liquor pumped from the syphons is in some towns also a problem; and it may have to be carted back to the works.

A practical illustration of this—and the cost involved—was recently mentioned by Mr. Ralph Halkett, of Sheffield, in his paper read before the British Commercial Gas Association, at Southampton.* In the first mile of a supply main, 200 to 300 gallons of water were removed every day at the syphons.

(4) Many gas mains and services (which have sunk or which have been laid badly) are now certainly partially choked with condensed water, and dry gas passing through these mains would soon remove this water and restore the original carrying capacity of the mains or services.

(5) It has been proved that naphthalene covered with a film of water has its rate of vaporization greatly reduced, but a gas free from both moisture and naphthalene would more rapidly take up naphthalene deposits from mains and services, which under present conditions, while distributing moist gas, are only very slowly removed. When gas is super-saturated with naphthalene, the excess appears to be carried along in the form of minute crystals which have a tendency to be deposited along with the moisture, and it is common knowledge that the deposition of naphthalene and water are associated. It is possible that, in the absence of water deposition, much (if not all) of this naphthalene would be mechanically carried to the point of consumption, and burnt.

(6) It has been very thoroughly investigated, and it is fully established, that the deterioration of gas meters is closely associated with the deposition of moisture, as regards both damage to leathers and the rusting of the cases. It must be borne in mind that the partial drying of the gas does not remove the oil vapours; and a meter working with a dry gas rich in hydrocarbon vapours is working under ideal conditions for long life. Examples of meters which have worked with dry and moist gas respectively are on view; and the difference is very marked.

(7) Water vapour is, of course, an inert gas, and its removal, while reducing the volume of the gas by from 1 p.ct. to 2 p.ct., would increase the calorific value in the same proportion. In practice, this means that:

(*a*) Steaming in continuous vertical retorts might be carried slightly further than at present while still giving the same district calorific value; or alternatively

(*b*) a little less oil will be used in carburetting water gas; or

(*c*) a richer gas may be distributed.

At present the removal of moisture occurs to some extent in the distributing system, but, unfortunately, with the attendant disadvantages of corrosion.

(8) With the water vapour removed, washing for naphthalene becomes much more efficient, since oil containing water is relatively inefficient as compared with dry oil.

(9) With the new type of waterless holder, the danger resulting from the presence of water in the sealing tar would be removed, for in cold weather no ice could be formed, though the tar might still need to be warmed or otherwise treated to reduce its viscosity in such weather.

* See "JOURNAL," Vol. 180, p. 130.

POSSIBLE METHODS OF PARTIALLY DRYING GAS.

1. One method which suggests itself at once is that of compressing the gas and cooling after compression, draining away the water, and re-expanding the gas. To obtain about 60 p.ct. efficiency of extraction, a pressure of 40 lbs. per sq. in. would be necessary; and in order for the process to be continuous, provision would have to be made for a stand-by plant. About 100 H.P. per million c.ft. of gas per day would be necessary, and provision would have to be made on a large scale for cooling the compressed gas. No one would lightly entertain such a project unless the gas is to be distributed under high pressure.

In the Life of Meters Committee of the Institution of Gas Engineers, 1919, there is a reference to Mr. Helps' results where the gas was compressed to about 50 lbs. and afterwards distributed at under 5 lbs. The greater portion of the moisture was thus eliminated, and a certain proportion of soluble salts found in the condensate. The condensate was about 80 gallons per million c.ft. treated.

2. Another obvious method is by cooling the gas to the required dew-point. By means of a refrigerating system, any necessary degree of drying can be obtained. The refrigerating plant would, however, cost more than the compressing plant, and it would be a more complicated engineering job. Further, if the dew-point were reduced below freezing-point, the water would be removed as ice, and the process would not be a continuous one, but would necessitate the employment of at least two chambers in alternating sequence, involving the manipulation of valves. Naphthalene and probably other hydrocarbon constituents would also be deposited under such conditions. The useful range of such methods is, therefore, limited to the production of dew-points well over 32° Fahr.

The treatment of the gas by spraying with artificially cooled water is open to the same objections that refrigeration is costly and complicated, and that deposition of naphthalene and other hydrocarbons would contaminate the water and necessitate filtration.

3. Of the solid absorbents available, silica gel is perhaps the most promising; and, as has been recently demonstrated, air can be successfully treated for moisture removal. Even though, however, it might be applied to gas drying, there is the objection that we are handling a solid material, which does not lend itself to a continuous process but would probably involve intermittent working; the beds of the material being changed as required in much the same manner as in the usual method of purification.

The revivifying of the silica gel is a process requiring heat treatment and considerable experience of the material to carry out successfully without the incurring of any deterioration in the material. Silica gel also absorbs benzole, though this is given off again as the material becomes saturated with moisture; and this in an intermittent process would involve a varying calorific value. Again, it is known that this material has not an indefinite life, and the price is prohibitive.

4. Calcium carbide has been suggested as a drying agent, as this would enrich the gas at the same time. The added calorific value would, however, cost some 2s. per therm, and, in any case, the gas would also be fouled with undesirable impurities, necessitating the installation of some form of catch-box. It should be noted that if the carbide is left in contact with the gas after the first reaction has been carried out, the dehydration effect is partly lost, as the calcium hydrate formed by the interaction of moisture and calcium carbide would later be converted to calcium carbonate, and the water released again.

5. Calcium chloride is the cheapest and most practicable of the many other solid reagents suggested, but it has still the objection that the process is not continuous, and the repeated evaporation of the calcium chloride solution formed into the solid form would involve a fair amount of supervision and labour. Solid reagents cannot be cooled very easily while working, though this might not prove to be absolutely necessary.

6. Of the liquid reagents suggested, a process could be worked out for sulphuric acid, but few would care to handle and re-concentrate such a corrosive and dangerous liquid when harmless liquids are available.

The acid would have to be kept fairly strong, as otherwise corrosive action on the plant would be very rapid; absorption of hydrocarbons would also most probably take place. If the diluted acid is to be used on a sulphate of ammonia plant, the process binds one always to use vitriol for its manufacture; and in actual practice, it is doubtful if all the moisture absorbed would be driven off by the heat of reaction in the saturator, and external concentrators might have to be employed.

Glycerine has also been proposed, but a mixture of 86 p.ct. of glycerine would have to be used to have the same low vapour pressure as a concentrated calcium chloride solution; and it would be very viscous at that concentration. In evaporating glycerine there is also a loss by vaporization at concentrations over 70 p.ct.; and even if distillation is carried out in a vacuum, considerable quantities of glycerine are given off from solutions

exceeding 80 p.ct. The cost of the glycerine would also be a material consideration.

THE "DRI-GAS" PROCESS.

In the course of our investigations of the methods of moisture-removal referred to above, we became aware of the fact that Messrs. W. C. Holmes & Co., Ltd., had been for some time engaged on research work in connection with this problem. Experimental work had already been carried out in the use of liquid absorbents, resulting in a series of patents being taken out covering this method, and also the use of other absorbents in various forms of washing apparatus, particulars of which have already appeared in the Technical Press.

The most suitable liquid was found to be a concentrated solution of calcium chloride; the degree of drying which can be accomplished by such a solution being, of course, dependent on the vapour pressure, which varies according to the concentration and the temperature.

The maximum concentration is limited by the solution forming crystals of the hydrate $CaCl_2.6H_2O$; and the concentration of about 40 p.ct. calcium chloride is the most that can be obtained at ordinary temperatures without incurring this danger. The solution of calcium chloride becomes heated by the absorption of water vapour, and must accordingly be cooled. The temperature of this solution will, therefore, be limited by the temperature of the cooling water available. Such a solution will give a reduction in the humidity content of coal gas of 60 to 65 p.ct.; and Tables III. and IV. give data based on the removal of 60 and 65 p.ct. moisture respectively.

TABLE III.

Temperature of Initial Saturation, Deg. Fahr.	Moisture Content in Grains per C.Ft.	Moisture Content at 40 P.Ct. Initial Humidity.	Dew-Point Corresponding with 40 P.Ct. Humidity. Deg. Fahr.	Moisture to be Removed.		Reduction in Gas Volume. P.Ct.	Lowering of Dew-Point. Deg. Fahr.
				In Grains per C.Ft.	Lbs per Million C.Ft.		
80	11·69	4·67	54	7·02	1003	2·26	26
70	8·27	3·31	45	4·96	709	1·56	25
60	5·8	2·32	36	3·48	497	1·07	24
50	4·01	1·6	27 5	2·41	344	0 73	22 5
40	2·73	1·09	19 5	1·64	234	0·48	20 5

TABLE IV.

Temperature of Initial Saturation. Deg. Fahr.	Moisture Content in Grains per C.Ft.	Moisture Content at 35 P.Ct. Initial Humidity.	Dew-Point at 35 P.Ct. Humidity. Deg. Fahr.	Moisture to be Removed.		Reduction of Gas Volume. P.Ct.	Lowering of Dew-Point.
				Grains. per C.Ft.	Lbs. per Million C.Ft.		
80	11·69	4·1	50	7·59	1080	2·46	30
70	8·27	2·9	41·5	5·37	768	1·69	28·5
60	5·8	2·03	32·5	3·77	538	1·17	27·5
50	4·01	1·4	24·5	2·71	378	0·79	25·5
40	2·73	0·95	17 0	1·78	254	0·52	23

Provided that the temperature of the calcium chloride solution is kept down to that of the incoming gas, the dew-point of the incoming gas can be reduced by 25° to 35° Fahr., according as the initial temperature varies (say) from 50° to 80° Fahr.

Messrs. Holmes submitted a scheme with guarantees for the partial drying of the gas and the extraction of naphthalene, which was adopted by my Company; the plant being put to work in June, 1926. The installation comprises, as shown in the accompanying sketch, a Holmes patent rotary brush scrubber washer in two sections, each of six chambers, driven by a steam engine placed centrally between the sections. The first six chambers are supplied with calcium chloride solution for gas drying, and the second six with gas oil for naphthalene washing in the usual way; and probably it is largely owing to the gas, and therefore the gas oil and also the brushes, being free from moisture that we obtain practically complete elimination of naphthalene—certainly down to below 1 grain per 100 c.ft.—using only about 14 gallons of gas oil per million c.ft. of gas treated.

A picric acid solution shows only a trace of naphthalene picrate precipitate after a prolonged test. The plant also comin the cast-iron tank; and this solution is pumped into the used and dilute calcium chloride solution; the exhaust steam from the washer engine being more than sufficient for this purpose. A cast-iron tank for the calcium chloride solution is fixed near the washer, so that the washer overflow gravitates into it. As the absorption of water vapour involves change of state from the gaseous to the liquid, it is, of course, accompanied by the evolution of heat, necessitating the cooling of the solution. This is done externally by a compact rack cooler designed for both air and water cooling.

METHOD OF WORKING.

A calcium chloride solution of approximately 40 p.ct. strength is first formed by dissolving the solid calcium chloride in water in the cast-iron tank; and this solution is pumped into the washer through the rack cooler. The solution picks up all the moisture carried in suspension in the gas, and also two-thirds of

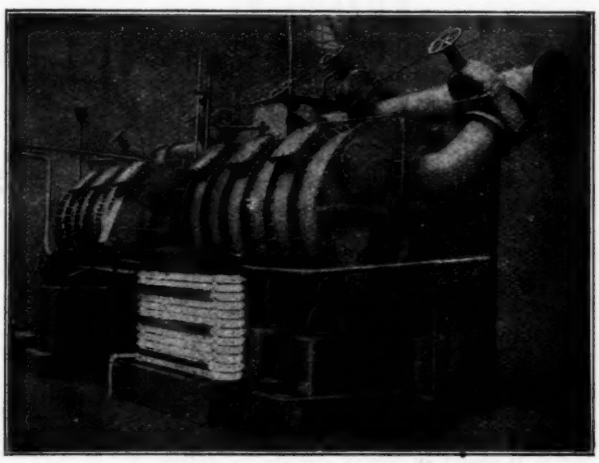


Fig. 3.

the moisture present as water vapour; and it becomes heated and diluted in the process, and overflows from the washer into the stock tank. This solution is constantly re-circulated; but about 5 p.ct. of the solution, after passing through the cooler, is tapped-off, and runs over the evaporator, the remaining 95 p.ct. feeding into the washer. An alternative method of cooling by separately circulating the contents of one or more bays of the washer through the coolers is sometimes adopted, to secure a more rapid heat removal; but this is not essential.

The evaporator is placed directly above the stock storage tank, so that over-evaporation, if it occurs, is rendered immaterial, and any solution which on cooling might solidify is diluted by the stock solution in the tank. The advantage of this arrangement is that only a minimum quantity of solution need be passed over the evaporator; and therefore the additional cooling required (consequent on the heating of such solution) is negligible. The calcium chloride solution is kept at from 76° to 80° Tw., according to the time of the year. If too con-

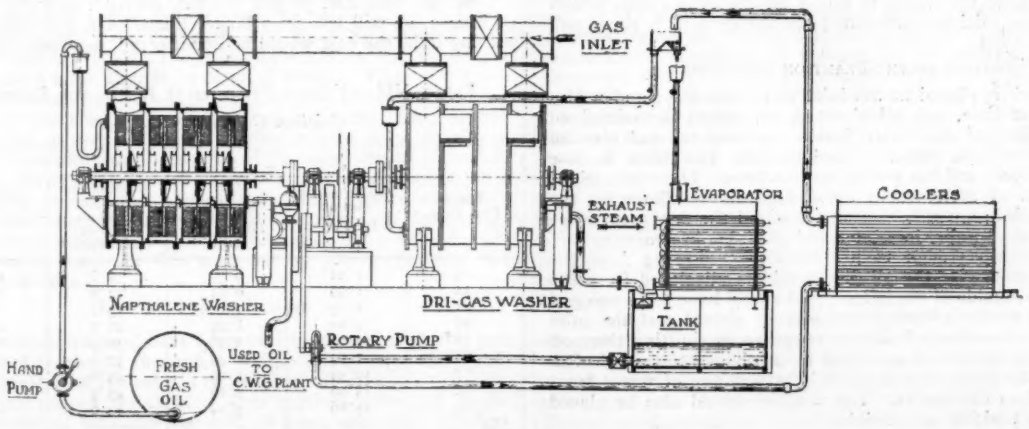


FIG. 2.

TABLE V.—*Increase in Dew-Point in Passage through Holder.*

Date.	Gas Output per Day. 1000 C.Ft.	Air Temperature. Deg. Fahr.	Dew-Points, Deg. Fahr.			Increase in Dew-Point through Holder Deg. Fahr.	Net Lowering of Dew-Point Deg. Fahr.	Margin between Final Dew-Point and Air-Point. Deg. Fahr.
			In Washer.	In Holder.	Out Holder.			
1926.								
Aug. 27	541·1	69	71	45·0	49	4·0	30	20
,, 28	499·2	75	79	49·5	53	3·5	26	22
,, 29	564·1	74	74	44·0	49	5·0	25	25
,, 30	516·4	70	74	42·5	45·5	3·0	28·5	24·5
					SUMMARY— Average increase = 3·87° Fahr. (Summer conditions.)			
Nov. 26	665·4	46	54	30·5	32·5	2·0	21·5	13·5
,, 27	617·7	44	51	30	33·0	3·0	18·0	11·0
,, 28	736·8	45·5	49·5	28	30	2·0	19·5	15·5
,, 29	683·8	41	48	28	30·6	2·6	17·4	10·4
,, 30	742·3	45	48·5	29	32·0	3·0	16·5	13·0
1927.								
Jan. 3	683·0	47·5	49	27	29·5	2·5	19·5	18·0
,, 4	739·0	47	48	26·5	29·0	2·5	19·0	18·0
,, 5	701·2	31·5	52	29·0	31·2	2·2	20·8	20·3
,, 6	672·1	51	51	28·7	29·9	1·2	21·1	21·1
,, 7	685·2	48	50	28·0	29·6	1·6	20·4	18·4
					SUMMARY— Average increase = 2·3° Fahr. (Winter conditions.)			

TABLE VI.—*Holmes "Dri-Gas" Plant—Results of Gas Dehydration, 1927.*

Date.	Time.	Gas Outlet Section.			Temp. of Cooling Water. Deg. Fahr.	Gas Inlet Section.			Dew-Point.	Number of Degrees Dew-Point is Reduced.
		Temp. Gas. Deg. Fahr.	Concentration of Solution. Deg. Tw.	Temp. of Solution. Deg. Fahr.		Temp. Gas. Deg. Fahr.	Concentration of Solution. Deg. Tw.	Temp. of Solution. Deg. Fahr.		
Oct. 5	9 a.m.	54	77	54	55	60	76·5	58	30	30
,, 6	9 a.m.	54	77·5	54	55	61	77	58	30	31
,, 7	9 a.m.	54	77·5	54	55	60	77	59	29	31
,, 8	9 a.m.	55	77·5	55	54	61	77	59	31	30
,, 9	9 a.m.	53	77·5	53	52	58	77	56	30	28
,, 10	9 a.m.	55	78	55	53	61	77·5	59	29	32
,, 11	9 a.m.	53	78	52	50	58	77·5	56	29	29
,, 12	9 a.m.	51	78	50	50	57	77	55	28	29
,, 13	9 a.m.	54	77	54	50	60	76·5	58	31	29
,, 14	10.30 a.m.	55·5	76·5	55	51	61	76	60	32	29

centrated (having regard to the minimum temperature in the cooler), it would, of course, solidify on cooling.

The absorption of water vapour from the gas is very rapid; being practically completed in the first four chambers. As long as the specific gravity is kept as high as practicable, and the temperature of the solution as low as possible, good results are consistently obtained; and the supervision chiefly consists in testing these two figures, which can be taken by anyone in a few minutes. The whole plant is remarkably "fool-proof" and simple to work; the chief precaution necessary being to avoid over-concentration of the calcium chloride solution, as otherwise this solidifies on cooling. Ten minutes per shift is all the time required for one man to look after the combined naphthalene and drying process. If any ammonia (which is very rarely found after oxide purifiers) is carried forward to the drying washer, carbonate of lime will be deposited and ammonium chloride formed. The latter, however, will be dissociated by the evaporator; and the resulting slightly acid solution would correct itself by decomposing the carbonate of lime already formed. The deposition of calcium carbonate in our case has been negligible, although we purposely allow a little ammonia to go forward to the purifiers.

Examination of the washer plates, shaft, &c., after eighteen months' work shows, so far, no trace of injury from such causes. A scale formation is found on the evaporator, which contains some calcium carbonate; but the growth is slow, and is easily removed.

POSITION OF THE PLANT ON THE WORKS.

The washer is placed at the inlet to the holders; and a film of oil (in our case, gas oil about $\frac{1}{16}$ in. thick) is maintained on the surface of the water inside the holders, and also on the surface of the cups. The oil film has been in use since June, 1926, and has proved satisfactory. There is a slight re-absorption of moisture in the holder, as is shown by the tables appended; but this has not increased the dew-point more than by 2° or 3° Fahr. in winter and 5° Fahr. in summer.

Care should be taken to prevent any "blowing" of the holders, as otherwise the oil film would be displaced from the inside to the outside of the holder, and would have to be pumped back. Any works adopting the process should test the inlet and outlet mains of each holder in sequence by shutting them off for at least 24 hours and pumping the syphons before and after this period, to make certain there is no leakage of water from the holder into the mains. The washer should also be placed in as cool a position as possible.

Alternatively, the gas can be dealt with by the "Dri-Gas" process, after the holder, when circumstances render this advisable; but treatment of the gas before the holders, combined with filming, has the advantage of reducing corrosion of framing and sheeting, and lengthening the safe life of the structure.

THE COST OF THE PROCESS.

Taking as a basis the dehydration of one million c.ft. of gas per day, the following is an analysis of the working charges at Taunton:

	s.	d.	
Capital charges and depreciation—			
12½ p.ct. per annum on £1500	10	4	per day.
Steam consumption—			
3 H.P. at 50 lbs. per H.P.-hour, and 1s. 6d. per 1000 lbs. steam	5	6	,,
Cooling water—			
300 gallons per hour at 3d. per 1000 gallons	1	10	,,
Labour and supervision—			
One man periodically visiting the machine—half-hour per day	0	9	,,
Oil, grease, and stores	0	6	,,
Calcium chloride	0	4	,,
Total cost	19	3	,,

Cost per 1000 c.ft. of gas treated, 0·231d.; and this would, of course, be still less on a larger plant. On a 5 million c.ft. per day unit, the cost would be about 0·15d. per 1000 c.ft.

TABLE VII.—*Vapour Pressures of Water and Saturated Calcium Chloride Solutions.*

Temp. Deg. Fahr.	Vap. Pressure. Grains per C.Ft.	Vap. Pressure of Sat. Calcium Chloride. Grains per C.Ft.	Dew-Point in Equilibrium with Sat. Calcium Chloride. Deg. Fahr.	Lowering of Dew-Point. Deg. Fahr.
23	1·31	0·58	6·8	16·2
32	1·99	0·84	14·0	18·0
41	2·85	1·12	19·7	21·3
50	4·01	1·55	26·6	23·4
59	5·60	1·98	31·9	27·1
68	7·72	2·49	37·6	30·4
77	10·54	3·16	43·8	33·2
83·3	13·06	3·18	43·9	39·4
85·1	13·86	3·14	43·6	41·5

TABLE VIII.—*Solubility and Specific Gravities of Saturated Solutions of Calcium Chloride*

Temp. Deg. Fahr.	Lbs. Calcium Chloride per Gallon of Water.	Specific Gravity. Deg. Tw. at 60° Fahr. (approx.).
32	5·95	74·5
35	6·05	75·5
40	6·15	76·0
45	6·30	77·5
50	6·50	79·0
55	6·70	81·0
60	6·95	83·0
65	7·25	85·5
70	7·65	89·0
75	8·15	93·5
80	8·85	99·5
85	9·75	108·0

At Taunton, service renewals cost us 0·5d. per 1000 c.ft. of gas sold, and meter repairs were 1d. per 1000 c.ft. of gas sold. The cost of syphon pumping was about 0·05d. per 1000 c.ft. of gas sold. The cost of attending to stoppages from naphthalene, rust, and water, before the plant was installed, was about 0·07d., making a total of 1·512d. per 1000 c.ft. of gas sold.

Calcium chloride solution is very cheap; the present market price of the solid chloride of 70 to 75 p.ct. purity being £5 12s. 6d. to £5 17s. 6d. per ton, carriage paid. The losses of the solution are small, and, in any case, we do not anticipate using more than 1 ton of fresh material per year. We have used only this amount in twelve months' working, to make up inadvertent losses.

In actual practice, results have been obtained which are given in the tables appended, from which it will be seen that the dew-point of the gas can be lowered by about 23° Fahr. in winter and 30° Fahr. in summer; and these could be much improved if a supply of cooler water were available. It is most convenient, in our case, to use river water.

In summer-time, the coolest supply for most works would be from a deep well or an underground gasholder tank, and the water can be continually re-circulated.

RESULTS ON THE DISTRICT.

It is evident that, apart from the better preservation of the mains and the reduction of leakage which will follow (consequent on the general adoption of steel mains with welded joints), the cost of the process will be saved again and again. The number of meters repaired in the twelve months following the adoption of the process was 30 cwt. lower than in the preceding twelve months and 25 p.ct. lower than the average of the four previous years. I am confidently anticipating that the cost of meter repairs will be at least halved. With the new type of standard or high-capacity meters, the leather diaphragms nearly touch the bottom of the meter cases, and the slightest deposition of water ruins the leathers. With dried gas, however, the leathers dip in oil, which feeds round the diaphragm by capillary action and maintains the leathers in good condition; and there is no rusting of the meter cases internally.

At Taunton, complaints of water in services and fittings, which formerly averaged about six per day, are now practically unknown, there having been two only in the last twelve months. The syphons throughout the town are dry, and care has to be taken that there is no leakage of gas in the syphon box covers. In only a few cases is water present in the mains syphons, and then only after heavy rain, proving that this water is from outside leakages; and these will be traced and stopped. Any works adopting drying will probably discover many leakages in this fashion. In porous ground, or ground of loose formation, there would be no leakage of water inwards, even in wet weather; but in water-logged ground, this is bound to occur if there are any leaks in the mains or services.

With wet meters there is the disadvantage that the water-line becomes low rather rapidly; but, fortunately, we had only a few wet meters in commission, and these we replaced with meters of the dry type. The difficulty could, of course, be got over by using other liquids in place of water. Thus a mixture of glycerine and water could be used, or alternatively a solution of calcium chloride of similar strength to that used in the washer; but probably the best method would be to employ a mixture of paraffin and anthracene of the same density as water.

As the water is extracted from the gas after passing the station wet meter, the same disadvantage exists as now—namely, that the diminution in volume (caused by the extraction of water) becomes reckoned as leakage; but a suitable correction can be made for this each day by noting the inlet and outlet dew-points.

TESTING FOR MOISTURE.

The methods adopted have been two in number: (1) The gas to be tested is passed through a weighed tube containing calcium chloride, and the tube is re-weighed after (say) 2 to 5 c.ft. of gas has passed through. This method gives the number of grains of moisture per c.ft. of gas; and after this has been corrected for temperature and pressure, the dew-point of the gas can be found by reference to suitable hygrometrical tables.

The second and quick method of obtaining the dew-point is by modification of one of the ordinary methods, and the apparatus is shown on the diagram herewith. A stream of coal gas

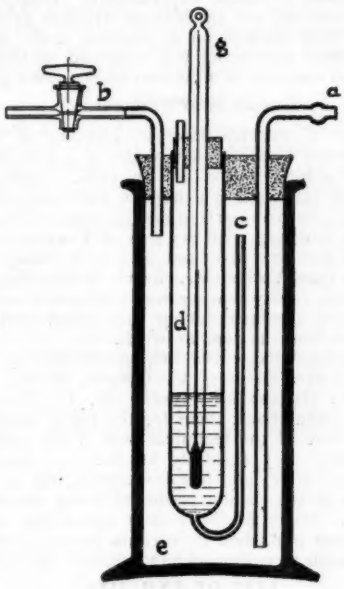


Fig. 4.

to be tested is passed through *a*, and has egress through tube *b*. If the finger is pressed on this tube, the gas finds an outlet down the capillary *c*, bubbling through the ether in *d*, and thence to the open air.

The temperature of the thermometer *g* and the tube *d* is, of course, rapidly lowered by the vaporization of the ether. As soon as the dew-point of the gas is reached, a film of moisture will be seen on the outside and at the botom of tube *d*; and the temperature of the thermometer is then read. The rate of bubbling, and hence the rate of the fall in temperature, can be governed by allowing part of the gas to escape at *b*. With practice, very consistent results can be obtained, and half-a-dozen tests can be made at different points in an hour. The results given by this method are from 1° to 2° higher than those obtained by the gravimetric method, and possibly this is due to the film of moisture being preceded by the deposition of hydrocarbons. In some works this apparatus gives erratic results, owing to the presence of hydrocarbons of higher dew-point than the moisture content; and in these cases the wet and dry bulb thermometer has been used and has given fairly consistent results. A recording hygrometer is now also on the market.

I might state here that we have continued to vaporize oil into the town gas supply, in order to coat all mains and services, &c., internally with a film of oil. We anticipated some difficulty with stoppages from dried rust carrying forward; but in practice we have not had occasion to use a force pump once during the last twelve months.

Gas supply has an advantage in competition with electricity that there is practically no chance of a general breakdown; but as against this, many consumers experience severe annoyance by constant blockages of naphthalene, rust, and water. The question of giving satisfactory service to the consumer (which is becoming the aim of the gas industry generally) makes the claims of the process such as to demand very careful consideration from everyone responsible for the distribution of gas. I do not, of course, suggest that gas dehydration is a panacea for all distribution troubles; but it is certainly sound practice and beneficial to remove on the works, instead of piecemeal on the district, a harmful constituent which is costly to distribute, and is of no value to the consumer.

I understand that some twelve other gas undertakings have Messrs. Holmes' process at work or in course of erection, seven of which are in operation; and it will be interesting to see how far their results tally with our experience at Taunton. The advantages claimed for the use of dry gas have been experienced for many years by American gas undertakings distributing natural gas, who never suffered from any corrosion in mains, services, or meters until they commenced distributing coal gas. Natural gas is, of course, practically free from moisture.

The subject cannot be dealt with fully in one paper; but most of the main points have been touched upon.

A very careful investigation has been carried out by Prof. Dr. E. Ott and F. Hinden, and is described in the February monthly bulletin of the Swiss Society of Gas and Water Industries. This research comprised a comprehensive study of the corrosive action of the various known impurities in distributed town gas;

and it is remarkable that over a period of 280 days intensive corrosion occurred with moist gas, whereas with dry gas over a period of 220 days no noticeable corrosion occurred. I have here a copy of a table of comparisons and also photographs of the interior surfaces of the samples of service pipes of varied compositions used in these experiments. This confirms the research work carried out by Messrs. Holmes prior to the development of their process on a working scale, when over a period of 150 days no rusting was observed on bright polished samples of steel exposed to a current of dry town gas.

Examples of Corrosion.

As a matter of general interest, samples of steel (which have been exposed to the action of dry gas and moist gas respectively) for a long period are on view. Samples of new meters are also exhibited which have suffered badly from the action of water; and comparison can be made with other meters that have been working with dry gas at Taunton.

The process was first tried-out on the working scale at the North Shields Gas-Works (Mr. F. G. Willis, Engineer). An existing Holmes rotary washer was used; and very encouraging figures were obtained during the month that the washer could be spared from its regular work.

I have to acknowledge the help given me by Mr. D. M. Henshaw and also Messrs. C. Cooper, M.Sc., and S. G. Watson, M.Sc. (Leeds), of Messrs. W. C. Holmes & Co.'s technical staff, and thank them for the ready information supplied. The whole of the technical side of the problem of gas drying has been very carefully studied and worked out by Messrs. Holmes' staff; and it was encouraging to see the close approximation to the results predicted being obtained in practical working. Much of the matter appearing in this paper has already been published in various forms in the Technical Press; and I wish to make acknowledgment accordingly.

LIST OF EXHIBITS.

Samples of mild steel (gasholder sheet) treated for 150 days with—

(*a*) Saturated gas.
(*b*) Gas at about 80 p.ct. saturation.
(*c*) Gas at below 40 p.ct. saturation.
(*d*) Is an untreated piece of the metal.

Samples of mild steel as above. On each piece a drop of ammonium thiocyanate solution was placed at the beginning of the 150 days' test. The strips were then submitted to the various conditions as above.

Consumers' meters which have been in use on dry and moist gas respectively, showing effects of corrosion in the latter case.

APPENDIXES.

Summary of Advantages of the Drying of Town Gas.

(1) Prevention of rust in mains.
(2) The use of steel mains and welded joints would become standard practice, with consequent reduced leakage.
(3) Steel piping can be freely used for services in place of the more expensive wrought iron; and the corrosion and replacement of services, if not entirely eliminated, would be reduced to negligible proportions.
(4) The cost of meter repairs would be greatly reduced, owing to the ideal conditions under which they would be working.
(5) The cost of syphon pumping is greatly reduced, and the trouble of disposing of syphon liquor avoided.
(6) Mains and services now partly water-logged will be dried-out and resume their original carrying capacity.
(7) Mains and services containing deposited naphthalene will more speedily have the naphthalene re-absorbed by the gas.
(8) Naphthalene washing becomes much more efficient, since the wash oil can be kept dry.
(9) Leakage can be traced, since the presence of water in mains or services indicates leakage or fracture of the main or service.
(10) The interior of the gasholders is constantly oiled, and only exposed to dry gas, and cannot possibly deteriorate.
(11) The cost of the labour of removing water and naphthalene stoppages is saved.
(12) A greatly improved service is given to the consumer, as there are no annoying stoppages in the supply.
(13) There is simultaneously an increase in gas sold, owing to the maintenance of full pressures of supply; and one of the chief causes of loss of prestige of gas undertakings is done away with.
(14) Frozen services and mains are a source of annoyance in some climates; and these would be obviated.
(15) A higher calorific value is obtained by the removal of an inert gas, and the cost of its distribution is saved.
(16) The oil film induced by oil atomization or vaporizing on the inner surfaces of mains, services, and meters becomes permanent, and is not washed-off by water.
(17) The unaccounted-for gas is more correctly known, as condensed water vapour need not be included in this figure.
(18) Consumers' meters deteriorated by wet gas tend to register slow, reducing the revenue from gas sales, and adding a false amount to the leakage account. Meters kept in good condition mean increased revenues.
(19) The extraction of cyanides, to prevent corrosion of mains, would not be so necessary with dry gas.
(20) The cost of boosting gas bought in bulk—such as coke oven gas—can be reduced, and an uninterrupted supply at full pressure rendered certain, by drying and extracting the naphthalene.

Instructions for Use of Vapour Pressure Chart.

If the gas enters the drying washer directly after passing through the purifiers and wet meter, and without undergoing a rise in temperature, it will be saturated with moisture; and the moisture content can readily be obtained from the vapour pressure curve. Thus at 70° Fahr., the gas will contain 8·25 grains of water vapour per c.ft.

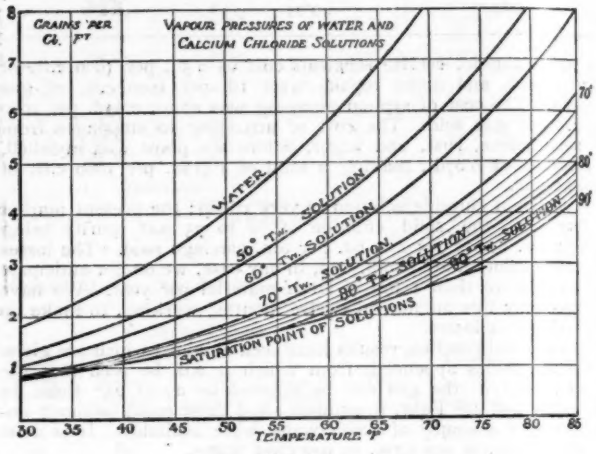


Fig. 5.

If any doubt is entertained as to whether the gas is saturated with water vapour, the dew-point may be ascertained, using the apparatus of which details are given in this paper—either the direct or gravimetric process being employed. Thus, if the gas is 65° Fahr., and contains 6 grains of water, its dew-point, as read from the graph, will be 62° Fahr.

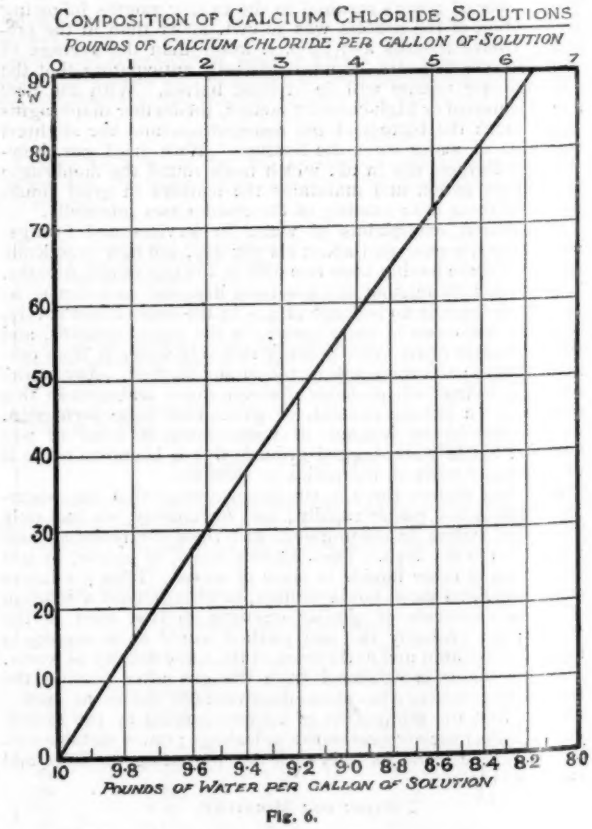

Composition of Calcium Chloride Solutions
Pounds of Calcium Chloride per Gallon of Solution
Tw
Pounds of Water per Gallon of Solution

Fig. 6.

To Find the Moisture Content and Dew-Point of the Treated Gas.

To find the moisture content of the gas after treatment with calcium chloride solution at any given temperature, proceed

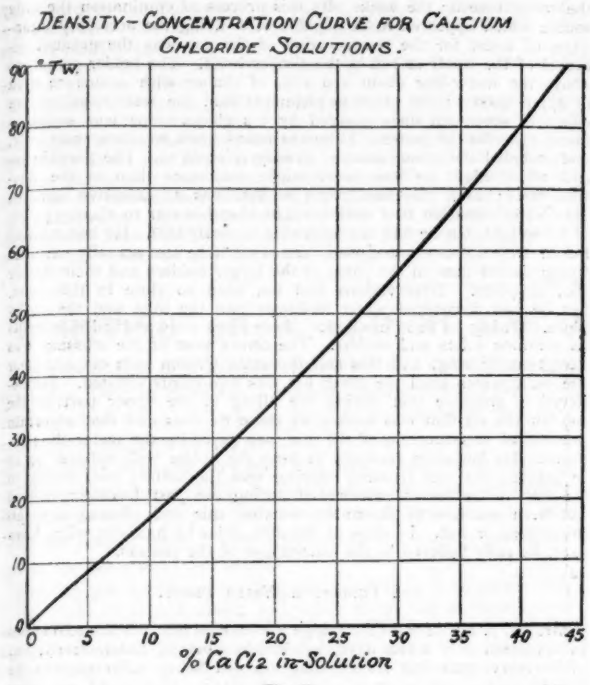


Fig. 7.

vertically from the said temperature until the calcium chloride curve is met, and then horizontally till the water vapour content is given—*e.g.*, at 60° Fahr. the gas, after treatment, will contain 2 grains of water vapour; and before treatment, gas saturated with moisture contains 6 grains, representing a two-thirds efficiency in extraction. From the water vapour curve it will be seen that 2 grains per c.ft. corresponds with a dew-point of 32° Fahr. on the gas-water graph.

Other examples are: Saturated gas at 80° Fahr. contains 11·75 grains per c.ft., which, after washing with saturated calcium chloride solution, is reduced to 3·5 grains per c.ft., representing a dew-point on the dry gas at 47° Fahr.

If the temperature of the gas at the washer outlet can be reduced to (say) 70° Fahr. it will be seen that only 2·7 grains per c.ft. would be left in the dried gas, representing a dew-point of 39° Fahr.; and, speaking roughly, every degree reduction in the outlet temperature of the gas means one degree lower dew-point.

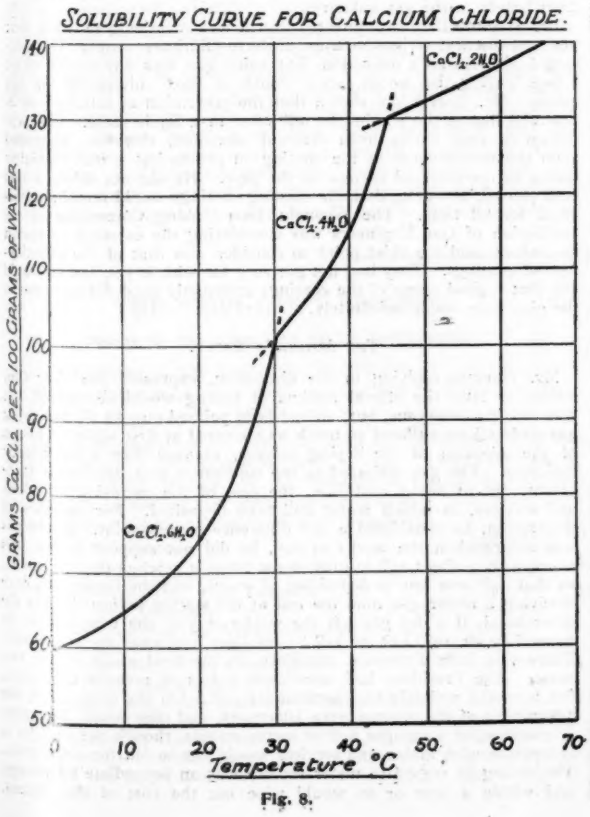


Fig. 8.

The actual results obtained in practice should agree very closely with those predicted by this graph, and the process should not be regarded as working satisfactorily unless nearly theoretical results are being obtained. It will also be seen that greatly improved results can be obtained if the temperature of the outlet gas is lower than that of the incoming gas.

Grains per c.ft. can be turned into gallons per million c.ft. by multiplying by 100 and dividing by 7. Thus 7 grains per c.ft. represents 100 gallons per million.

Discussion.

The PRESIDENT said the Association had rarely had brought before it a more important subject than that dealt with in the paper; and the members were indebted to the author for having given such complete and thorough information. If the system were to become at all popular, it would certainly make a change in their distribution system. There had been two troubles due to the composition of gas in the distribution system—one being naphthalene stoppages, and the other being deposition of water and rust. He believed one could consider the naphthalene difficulty as having been overcome completely, and there should be no further serious trouble through its deposition. The difficulty with regard to water deposits, however, so far as he knew, had been surmounted only by Mr. Harris at Taunton. A point to be considered in connection with this question was the present official method of testing gas. The official test for calorific value required the gas to be saturated with moisture at 60° Fahr., so that if gas were supplied free from moisture they would suffer a loss, which might reach as much as 1 p.ct. of the receipts. He did

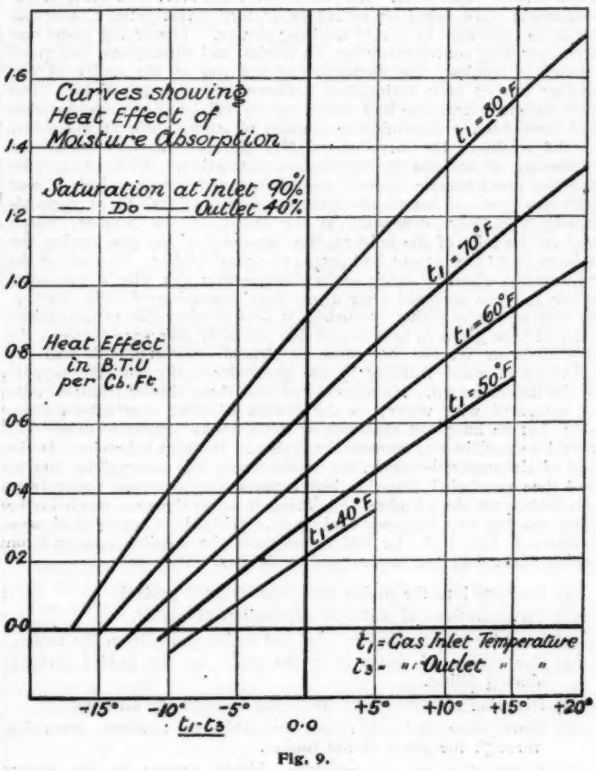

Curves showing Heat Effect of Moisture Absorption
Saturation at Inlet 90%
— Do — Outlet 40%
Heat Effect in B.T.U per Cb. Ft.
t1 = 80°F
t1 = 70°F
t1 = 60°F
t1 = 50°F
t1 = 40°F
t1 = Gas Inlet Temperature
t3 = " Outlet " "
t1-t3

Fig. 9.

not say that they would necessarily lose to that extent, however, and it might be that the advantages to be derived from the process would more than account for even such a loss as that. The National Gas Council had taken up the matter of testing with the Board of Trade, and he believed it was receiving favourable consideration.

DRYING GAS AT PORTSMOUTH.

Mr. T. CARMICHAEL, referring to the design and lay-out of the Portsmouth installation, said it was very similar to that described by Mr. Harris, but the capacity of the Portsmouth plant was 6 million c.ft. per day. The washer consisted of twelve bays, the first six dealing with the calcium chloride solution—the drying of the gas—and the other six, on the other side of the engine and driving gear, dealing with the elimination of naphthalene. The capital cost of the combined process at Portsmouth, including foundations, amounted to £4800, which was equivalent to £800 per million c.ft., or about half the cost of Mr. Harris's plant. The cost of working the process was 9s. 6d. per million, as against 19s. 3d. mentioned by Mr. Harris. The capital charges and depreciation figure was 6s., as against 10s. 4d. given in the paper; and steam consumption 2s. 6d., compared with 5s. 6d. The cost worked out to only 0·026d. per therm. The dew-point figures attained since the plant was put into operation last September were, at the gasholder inlet, 34° Fahr., and at the gasholder outlet 36° Fahr.; and he called attention to the difference of 2° as between the inlet and the outlet of the holder. At the Milton testing station—one of the official stations about two miles from the works—the dew-point was 37° Fahr.; at Waterloo Vale, five miles from the works, 42° Fahr.; and at the old gas-works of the Havant Company, six miles away, it was 43° Fahr. They were able

to send out dry gas from the Portsmouth Works within a day or two after the process was put into operation. There was no difficulty in getting dry gas out of the holder, but he understood that some members were having trouble. With regard to a loss of revenue of approximately 1 p.ct., referred to by the President, he said this was the figure experienced at Portsmouth; but the question had been raised with the Gas Referees, and he understood that they were very sympathetic. They had asked the Portsmouth Company to obtain figures for them at different points in the district and at varying distances from the gas-works. Though much concern had been expressed as to this loss, he believed that with further experience the actual condition of the dehydrated gas when it reached the point of combustion would not be so very different from that of the gas which had been sent out in the past, because the wet gas which had been sent out formerly had dehydrated itself to a very large extent in the condensation which had taken place. Therefore, in actual experience, he did not think they would suffer a loss of anything like 1 p.ct. but rather that there would be a credit balance in the end.

Experience at Weston-super-Mare.

Mr. James Taylor (Weston-super-Mare) said that water, naphthalene, and rust stoppages in mains and service pipes were extremely detrimental to the object which they should all keep in view—giving 100 p.ct. efficient service. The expense of clearing these stoppages was considerable in the case of many undertakings, but this was of trivial importance compared with the great annoyance it caused to consumers. Mr. Harris had increased the asset of goodwill on the part of his consumers by abolishing the need for the service pump. Mr. Taylor then referred to his own plant, of which he had had only a few weeks' experience. He pointed out, however, that some of his statements were based on recent laboratory investigations, and had yet to be confirmed by actual working results. The drying plant had been operating continuously for ten weeks, and throughout had given admirable results; the dew-point of the gas at the outlet of the washer having been maintained between 30° and 36° Fahr. The naphthalene extraction had been equally efficient; on no occasion had there been a determinable amount of naphthalene at the outlet of the washer. He corroborated Mr. Harris's remarks about the advantage of dry gas in naphthalene extraction. With wet gas he had had great trouble with oil emulsion, but this was entirely absent with dry gas. Though the gas had been maintained at approximately 33° Fahr. dew-point at the outlet of the washer, which was at the inlet of the holders, the dew-point of the gas leaving the holders up to the present had been 15° or 20° higher. In view of the information given by other undertakings—that gas with a dew-point below 40° was obtained after a few days' operation of their plants—he was naturally rather perturbed at this considerable re-saturation. He had been given to understand that the only difference between the conditions at Weston and those at Bristol or Portsmouth was the existence of wood framing in the gasholder tanks, for the support of the holder crown. He appreciated that these timber frames would be saturated with water, as the newest of them was fifteen years old; but he imagined that two or three weeks' exposure to dry gas would be sufficient to remove the moisture contained therein. At the end of six weeks, however, no improvement was perceptible, and he had then concluded that the timber posts were drawing water from the tank, past the oil film, and giving it up to the gas, much in the same manner as a lamp wick might do. With Mr. Cooper, of Messrs. Holmes & Co., Ltd., he had investigated the possible sources from which water could be re-conveyed to the gas. They were:

(1) Leakage into the mains from waterlogged ground.
(2) Accumulations of water in depressions of mains.
(3) Leakage into the holder inlet and outlet mains from the tanks.
(4) Conveyance of water from the tanks by the holder sheeting during filling.
(5) Diffusion of water from the tanks through the oil films.
(6) Conveyance of water from the tanks by capillary attraction through the pores of the timber.
(7) Evaporation of the moisture already present in the timber framing.
(8) In holders with trussed roofs, the possibility of the tie rods and other members breaking the oil film as the holder rose and fell.

It was a fairly simple matter to determine whether the gas was picking-up water from any of the first three causes. The only difficulty occurred in remedying leaks in connection with the inlet and the outlet pipes of the holders. The holder sheeting, in its rise during the filling of the holder, conveyed a certain amount of water to the gas, but experiments indicated that this factor only raised the dew-point of gas in the 500,000 c.ft. holder from 30° to 30·6° Fahr. Diffusion through the oil film was estimated to raise the dew-point from 30° to 33° with the same holder over a period of ten hours, and with a film ½ in. thick, which was the thickness used in the experiment. The film on the holder tank was actually $\frac{5}{16}$ in. thick, and the rise in dew-point should, therefore, be considerably less. Capillary attraction by timber posts projecting above the oil film in the tank was carefully investigated. The conditions were reproduced in a series of laboratory experiments, and they appeared to show conclusively that the oil film prevented capillary attraction of water through the timber. Experiments with thin sticks, with a rate of flow of gas proportionate to the 500,000 c.ft. holder conditions, gave approximately dry gas after a period of a few minutes only. Another experiment with a piece of 1½ in. by 1½ in. timber, exposed 30 in. above the oil film, gave a gas of 35·9° dew-point in under three hours. Left in position for eighteen hours, it gave 37·7° dew-point twenty minutes after restarting the gas flow. Experiments with a lamp wick dipped in water and with an oil film ½ in. thick superposed, showed that the wick permitted the oil to burn freely. When the oil was exhausted, the water rose up the wick. By this process of elimination the only source which appeared to be capable of evolving the necessary quantities of water for the re-saturation of the gas was the gradual removal of the water stored in the timber itself. The holder contained above the water-line about 400 c.ft. of timber with a surface area of about 4000 sq. ft. It was estimated that the total re-saturation effect in seventeen days covered by his observations was equal to about 1500 lbs. of water. This was based upon day-time tests only, and included the minor sources already referred to. The possible re-saturation might be less under night conditions than in the day-time tests; and, therefore, the 1500 lbs. was an excessive amount. He had information that timber might absorb water to about 33 p.ct. of its weight, but he had not been able to verify this. He had a small holder with a trussed steel roof, and from it he had actually obtained worse results than in the cases of the larger holders and their timber roof supports. Observations had not been so close in this case, but he had discovered water leakages into the inlet and the outlet pipes. Owing to their small size, these pipes were worked in parallel as common inlets and outlets. The centre post of the trussing was exceptionally long, and this and the main tension rods did not clear the tank water until the inner lift was two-thirds inflated. He believed it probable that during the filling of the upper part of the top lift the oil film was broken by these tie rods and that a certain amount of re-saturation of the gas took place by the water thus exposed. He had now arranged to keep the holder well inflated, so as to prevent the roof trussing dipping into the water; but, owing to the low temperatures experienced during the past fortnight, it had not been possible to determine whether this had effected any improvement or not. In spite of the difficulties he had met with, however, he fully believed in the advantages of the process.

The Tunbridge Wells Plant.

Mr. L. J. Langford (Tunbridge Wells) said that his plant had been in operation only a few days, but it was working satisfactorily, and preliminary tests had shown that the gas being delivered into the holders had a dew-point of about 32° Fahr. One could not argue with Mr. Harris that the process was not a good one, because he firmly believed it was up to the undertakers to take the water out at the works instead of taking it from the distributing mains and causing interruptions in the supply to consumers. The process had brought into prominence the question of the provisions of the Gas Regulation Act. It was an anomaly, of course, that the test should be made at a point where the gas, during the greater part of the year, had already given up much of its water content in deposition in the distributing mains, and the test of the gas collected at the consumers' dry meters was not a true record as compared with the works test, because much of the water had gone. Therefore, the undertakers had been losers all along the line, since the passing of the Act—at least, those who were working under therm Orders—and they were losing now. It was difficult to say what proportion of the water was being deposited in the mains, but it might be a large proportion of the whole; so that all gas undertakers should be greatly interested in having this anomaly removed, more particularly those who were installing dry gas plants. On the other hand, he was firmly convinced that they would reap great benefits by drying the gas. Surely large reductions in the costs of distribution repairs must be anticipated; and in view also of the greater efficiency they would be able to give to consumers, the process must ultimately prove of great benefit to the gas industry.

Mr. Stephen Lacey commented that it was surprising to think that this was the first serious attempt made to eliminate water. He challenged Mr. Harris's deduction that when gas was universally dried before leaving the works, steel would be used universally for gas mains. Mr. Harris had shown that the prevention of internal corrosion was due to the elimination of water in a liquid state. The protection of steel mains from external corrosion, therefore, depended upon the effectiveness of the coating in preventing water obtaining access to the external surface of the pipe. He did not think it had been proved, however, that the existing coatings would remain waterproof for all time. The Wrought Iron Tubing Committee of the Institution of Gas Engineers was considering the external corrosion of mains; and the chief point to consider was that of the effectiveness of coatings. They had not got very far with it yet, but he could say that a good many of the coatings commonly used did not protect the pipe from water indefinitely.

The Author's Reply.

Mr. Harris, replying to the discussion, expressed the view that sooner or later the official method of testing would be revised. It was unfair to everyone, but, as had been pointed out, he did not think gas undertakers suffered so much as appeared at first sight by reason of the adoption of the drying process, because they were already suffering. The gas delivered to the consumers was dried to a large extent, but at heavy cost—*i.e.*, the cost of the corrosion of mains and services, in which water had been deposited. For purposes of illustration, he considered a 30° difference in dew-point. If the gas was saturated at the works at 60°, he did not suppose that it was at more than about 45° in most cases when it reached the consumers, so that 15° was lost in deposition of water, and the consumers were receiving a richer gas than the test at the station indicated. On the other hand, if a dry gas left the works at 30°, the temperature increased by 9°, 10°, 11°, or 12° by the time it reached the consumers. There was little difference, therefore, in the final result in the two cases. The President had mentioned a loss of revenue of 1 p.ct., but it would probably be less than 0·1 p.ct. On the other hand, the advantages of the process were enormous, and they would be reaped in cessation of stoppages and of meter repairs, though the savings in connection with mains and services would not be felt for some years. The saving in regard to meter repairs was an immediate advantage, and within a year or so would wipe out the cost of the process.

With regard to the Portsmouth plant, he asked Mr. Carmichael if the plant was at the inlet or the outlet of the holder, and if any oil was used for filming.

Mr. CARMICHAEL said that the plant was at the inlet. He used Duckham's oil for filming.

Mr. HARRIS, continuing, said the cost per therm at Portsmouth was remarkably small. It was not a question of whether undertakers could afford to use the plant, but whether they could afford to do without it. There was nothing good to be said about the distribution of water vapour; it was an active corrosive. If a man bought a motor-car, he immediately bought a garage also, in which to keep it out of the rain. Gas mains, however, were "in the rain" all the time. A very important point was the better extraction of naphthalene. If one dried the gas before extracting the naphthalene, one would have difficulty in finding any trace of naphthalene in the washed gas. In an ordinary naphthalene washer, there was bound to be a little deposition of water, which settled underneath the oil. A wet brush could not take up oil to any extent, but with dry brushes soaked with oil one obtained a fine washing; and with naphthalene washing there was double the efficiency, using dry gas. He considered Mr. Taylor would get over his difficulty with the timber framework. In reply to Mr. Lacey, he said that internal corrosion could be stopped. External corrosion depended on covering. When at Bournemouth some twelve months ago, he had seen steel mains which had been laid twenty years in sand, which presumably contained a certain amount of salt; and those mains were then just as good as when laid. The point was to coat the mains adequately, and to use a double coating if necessary.

BURSTING OF A 24-INCH GAS MAIN: AN INTERNAL EXPLOSION.

A gas explosion of a peculiar character was recently experienced in a town in Scotland. A 24-in. cast-iron main pipe had just been laid from one of the station governors at the gas-works for a distance of 500 yards. The pipe was laid without the gas being brought forward, and was tested in sections by air as the work proceeded. In due course, the gas was turned on at the works, and, passing through the station governor and along the line of pipe, it displaced the air through a 2-in. vent pipe at the far end of the main.

After the gas had been passing for about 8 to 10 minutes, one of the pipes exploded about 440 yards from the governor and within 60 yards of the end of the pipe. The laying of the pipe had been completed for some days prior to this. The track had been filled-in and consolidated, and the paving setts laid.

Immediately before the explosion occurred, it was observed that the gas and/or air coming from the 2-in. vent pipe was slightly warm, and gave a dark moist deposit on the hand. When the explosion occurred, there was an upheaval of the street, accompanied by a noise described as a "dull thud." A certain amount of sand and dust flew upwards. The pipe was laid bare on top, and one length of pipe was found to be fractured longitudinally; a piece about 7 ft. long by 15 in. wide being burst from one side. No flame was observed at any time. No personal injury occurred, though a number of employees were within a few yards of the point where the explosion took place. The joints of the adjacent pipes were not even disturbed.

The effect of the repercussion at the gas-works end of the main was to throw-up the governor bell, break the top cast-iron cross bar, throw-over one of the guide columns, and deposit the bell on the floor—fortunately clearing the other two governors situated close by on either side of it. The gas, which had not ignited, was turned off. No appearance of fire due to explosion was seen anywhere, and there was no external flame to cause the explosion. On this point, there is not the slightest vestige of a doubt.

For those who desire to theorize on how this explosion occurred, it might be explained that the 24-in. pipes in question were procured from the Government Disposal Board, and had been used for conveying water, apparently from a peat moss, and containing clay. The pipes had been coated originally with Dr. Angus Smith's solution, both internally and externally, but there was a clay-like deposit inside the pipes, which was roughly brushed out before laying, but not thoroughly washed out. It was found that, after brushing out, there still remained a very fine deposit on the inside surface of the pipes. This deposit, in the form of a powder, upon analysis, was found to consist of:

	P.Ct.
Moisture	5·61
Organic matter	17·27
Insoluble matter (silica, &c.)	3·26
Iron oxide and alumina (chiefly alumina)	10 69
Calcium carbonate	57·00
Magnesium carbonate	5 98
Alkalis (by difference)	0·19

It will be seen that the substance was neither explosive nor combustible, but contained sufficient organic matter to assist combustion.

It has been suggested that the cause of the explosion was the fine state of division of the deposit, and that in these circumstances the gaseous explosive mixture would condense on the suspended dusty particles. Slow oxidation of the coal gas would be promoted, and the temperature would rise to the ignition-point of the coal gas-air mixture. This action is familiar in the automatic gas lighter.

Before attempting to pass the gas through the main a second time, means were taken to create a moist atmosphere within the pipe, in order to try to bring down the fine dust which might still be in suspension. A light temporary bell was placed in the governor tank, which was held down by light wire ropes, so that they might give way should trouble occur again. A 10-in. vent pipe was set up at the extreme end of the main, and at the outlet of the governor about 800 to 900 c.ft. of nitrogen gas was delivered into the main to form a column of inert gas between the air in the pipe and the coal gas. The gas was turned on, a slight pressure being maintained at the far end by means of a controlling valve; and on this occasion everything passed off successfully.

Several years ago nearly two miles of 20-in., 14-in., and 12-in. pipes had been laid in a similar manner; and when it was desired to turn on the gas, a 2-in. vent hole was cut at the far end of the new main, to allow the air to be discharged. On that occasion everything passed off successfully. In this case the pipes were coated with Dr. Angus Smith's solution, and were perfectly clean.

These are the facts, and it may be left to those interested to form ideas as to what actually caused the explosion.

The writer is of opinion that, if the pipes had been flushed with water and thoroughly mopped clean before being laid, there would have been no explosion even with the 2-in. vent pipe, and, further, if a 10-in. in place of a 2-in. vent had been used, even with the dusty pipes, there would have been no explosion. In any case, where in doubt, it would be good policy to admit a column of nitrogen gas between the air and the coal gas when carrying out work of this kind.

THE "DRI-GAS" PROCESS.

Plants in Operation and Under Construction.

At the meeting of the Southern Association of Gas Engineers and Managers which was held at the Hotel Cecil, Strand, W.C. 2, on Nov. 16, Mr. Harris, of Taunton, read a paper on the partial drying of town gas. In view of the attention which is being paid to this problem, and to the "Dri-Gas" plant manufactured by Messrs. W. C. Holmes & Co., Ltd., in particular, the following list showing the plants which are either in operation or under construction is of interest.

Name.	Capacity. C.Ft. per Day.
Taunton Gas Company	1,500,000
Weston-super-Mare Gas Company	2,500,000
Bristol Gas Company	6,000,000
Bournemouth Gas and Water Company	10,000,000
Portsmouth Gas Company	6,000,000
Tunbridge Wells Gas Company	2,000,000
Long Eaton Gas Company	2,000,000
Gas Light and Coke Company (Staines Works)	1,500,000
Colne Gas Company	2,000,000
Blackpool Gas Department	5,000,000
Cheltenham Gas Company	3,000,000
Derby Gas Light Company	5,000,000

INSTITUTION OF CHEMICAL ENGINEERS.

Forthcoming Conferences.

The Institution of Chemical Engineers announce a series of meetings to be held on Dec. 7, 8, and 9, at the Chemical Society's Rooms, Burlington House, Piccadilly.

On the Wednesday there will be one session only, at 5 p.m., when the President (Sir Alexander Gibb) will take the chair, and Mr. Norman Swindin will read a paper on "Submerged Flame Combustion."

The two sessions on the Thursday will be devoted to a discussion on "Refrigeration."

On the Friday, also at 5 p.m., with Mr. W. A. S. Calder (Vice-President) in the chair, Mr. W. J. Jones will read a paper entitled "The Problem of Industrial Lighting, with some reference to the Chemical Industry." At 8 p.m. on the same evening, Mr. William Macnab presiding, two papers will be read—one of them on "The Properties of Silica and Fireclay Refractories in Relation to Industrial Usage," by Mr. A. T. Greene.

The President and Council of the Institution will be pleased to welcome all who may be interested in any of the above subjects. Applications for admission to any particular session should be made on or before Friday, Dec. 2, to the Hon. Secretary, Abbey House, Westminster, London, S.W. 1.

NOTES ON HORIZONTAL SETTINGS: WITH SPECIAL REFERENCE TO SILICA RETORTS.

By STEPHEN HAY, of the Beckton Works of the Gas Light and Coke Company.

[Before the Southern Association of Gas Engineers and Managers, Nov. 16.]

Silica has been the subject of many papers recently; but so popular is it for debate, and of such importance for the future of high-temperature carbonization, that I feel, in presenting these notes to you, that no apology is required.

The need for maintaining the highest standard of carbonizing and the maximum duty from existing horizontal plant has led to increased carbonizing temperatures, and at Beckton to the exclusive use of 95 p.ct. silica retorts. In 1922 special experiments were carried out in the laboratories at Beckton with numerous coals, and it was found that, with increased carbonizing temperatures, a higher yield of therms per ton of coal resulted.

Chart A shows the result from a Durham coal. The temperatures were not carried beyond 1050° C., but it will be noticed that the "therms per ton" curve shows no sign of flattening-out. It is interesting to note from the tests described in the Sixteenth Report of the Gas Investigation Committee that a reduction of 60° C. represented a loss of four therms.

Chart B shows the relation between therms per ton and temperatures of combustion chambers with constant throughput. Little was known at this time about the temperature difference between the combustion chamber and the inside of the retort for varying throughput, but it was realized that if this difference was in the neighbourhood of 300° C., and a retort temperature exceeding 1050° C. was to be maintained, fireclay would not be a suitable refractory. The temperature difference was eventually found to range between 250° and 300° C.; and Chart C is typical of readings taken at Beckton.

Table A shows the average life of retorts, as resetting became necessary.

Table B shows the number, dimensions, and life of various makes.

Unfortunately, no reliable data as to the temperatures of combustion chambers are available anterior to 1920, but the records kept in 1920 and 1921 show the average to be in the neighbourhood of 1100° C. There is no reason to suppose that previous to this date the temperatures were any higher. Indeed, the thermal outputs per ton of coal were low, and improved with the increased temperatures in 1922.

Chart D shows the therms per ton and the average temperatures of combustion chambers.

In making any comparison between refractories, temperature is such an important factor that it is better to ignore figures earlier than 1922 in dealing with Table A. In 1923 and 1924 the average age of fireclay retorts in days showed a steady reduction, with a consequent increase in the number of retorts reset. For the lengthened life in 1925 there is a special reason. Only 300 retorts were reset, and these had been worked at comparatively low temperatures, because of the type of charging machine and the size of the charge.

TABLE A.—*Showing Life of Retorts.*

Year.	No. of Retorts Reset.	Average Days.	Retort-House.	Coal Carbonized per Retort.
				Tons.
1914	400	1420	..	..
1915	300	1860	..	..
1916	640	1730	..	..
1917	100	1450	..	..
1918	500	1880	..	..
1919	700	2030	..	..
1920	300	1990	..	..
1921	No. 7 House Reconstructed			
1922	894	1890	..	..
1923	710	1505	7	765
			12	2363
			3	1014
1924	992	1350	4	1570
			9	1568
1925	300	1948	1	2109
1926	300	1933	5	2276
1927	300	1272	8	1499
	270	1069	6	1662

It is unnecessary here to dilate on the troubles accruing from high temperatures and small charges, but the writer wishes to stress the point that the full benefit of silica can only be assured when the retort is filled to 60 p.ct. or over.

In 1926 the plant dismantled had worked 1933 days. Eighty of the 300 retorts taken out were 95 p.ct. silica, and there is little doubt that the remaining 220 clay retorts in this house were long overdue for resetting. In fact the five tier clay retorts, 44 in all, were reset after 1290 days.

In the present year, retorts in two retort houses have been reset, 300 in one and 270 in the other. In the house of 300 retorts one-third were of 95 p.ct. silica segmental, and 200 were moulded siliceous. The latter were, and had been for some time, in a very bad state, whereas the 95 p.ct. silica retorts were in better condition than is generally accepted for clay retorts when demolished.

In the 270 house, the retorts were 95 p.ct. silica. The reasons for the short life are discussed later, but it is pointed out that with fireclay or siliceous material the life would probably have been less than 500 days. The life of retorts should be expressed in tons of coal carbonized per retort, rather than in days worked.

That the temperatures had increased beyond the working limit of fireclay was evident; and it was decided, in 1922, to adopt the silica segmental retort as a standard. In the light of

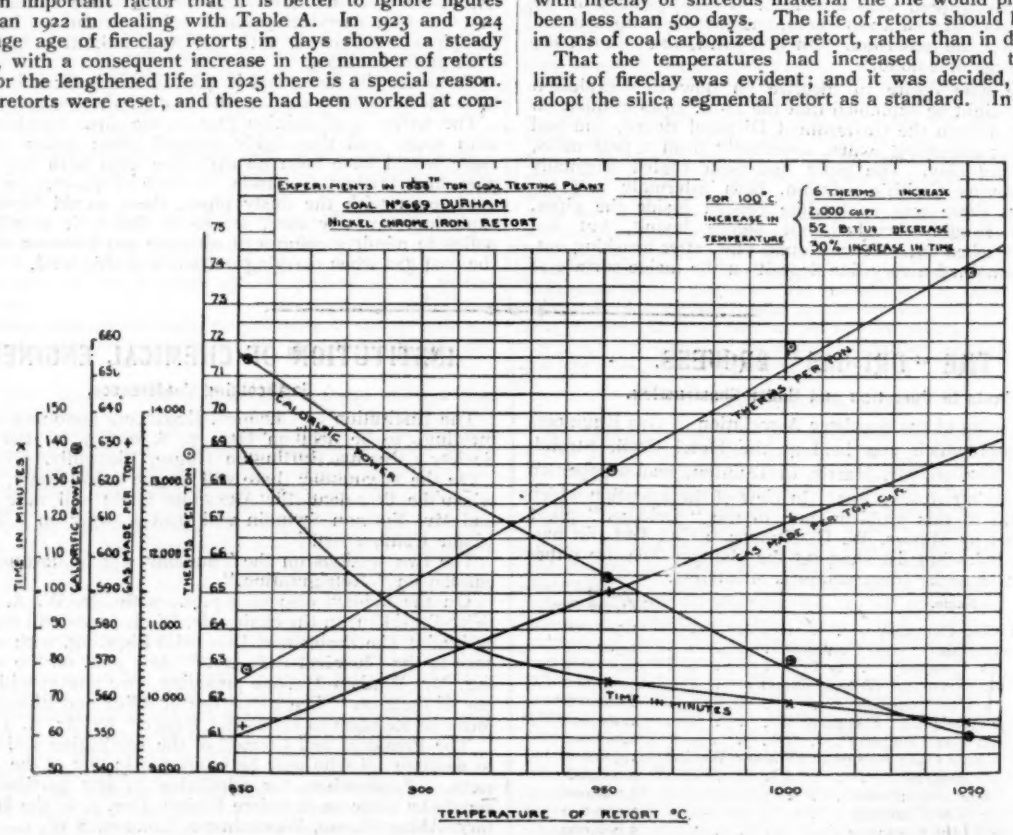


CHART A.

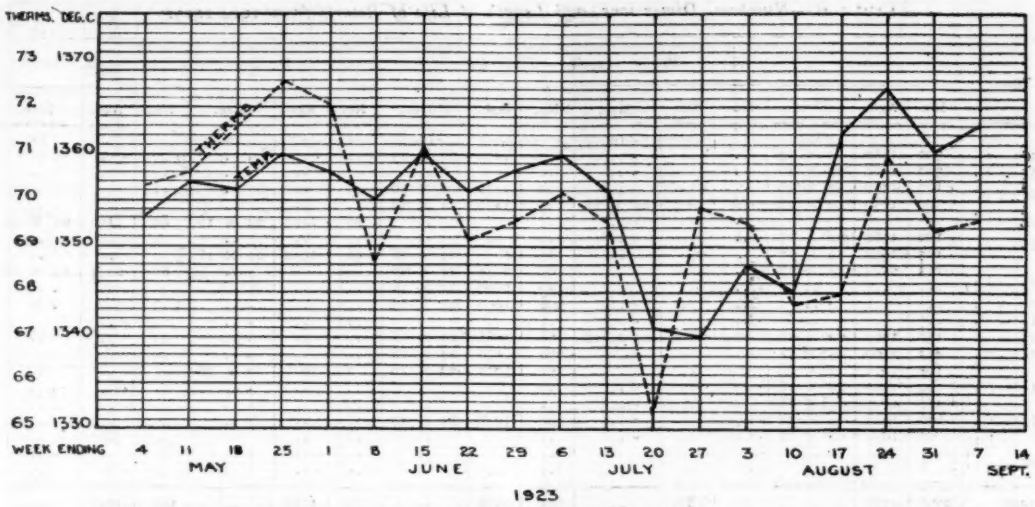


CHART B.—SHOWING THE RELATION BETWEEN THERMS PER TON AND TEMPERATURE OF COMBUSTION CHAMBER.

our experience, the writer believes that for combustion chamber temperatures not exceeding 1350° C.—which, of course, means an average temperature of 1325° C.—siliceous segmental retorts would probably have a reasonable life, but not so long as silica.

The reasons for adopting silica may be summarized as follows:

(1) Temperatures increased beyond the working limit of fireclay or siliceous material.
(2) Superior conductivity, enabling the working of heavy charges and shorter duration.
(3) Increased throughput, and therefore cheaper manufacturing costs.
(4) Greater flexibility in regulating stock of gas.
(5) Increased tonnage carbonized during life of retorts.

Silica segmental retorts were first introduced at Beckton in 1916, when eight retorts were built into our standard five-tier setting; the two top retorts being built of moulded fireclay. The silica retorts had a life of 2100 days and were in very good condition when pulled out.

In 1919, eighty silica segmental retorts were built; and these, as previously mentioned, were in far better condition than the clay retorts, after 1933 days' work under similar conditions in the same retort house.

In 1921, when No. 7 House was remodelled, our experience with 95 p.ct. silica retorts, though very promising, was not sufficient to warrant their selection for so large a plant; and fireclay was decided upon. The fireclay retorts completely failed, and after 536 days had to be reset with 95 p.ct. silica.

It is widely known that silica in coke oven walls has a very long life; and there is no reason why we should be content until the life in horizontal settings nearly approaches that in coke ovens. It must be remembered that conditions in coke oven plants are not quite comparable with gas-works practice. Coke oven plants are usually kept under fire throughout their life, and, gas being the residual, tightness of the oven is probably not so important as is the case with retorts. Another important point in comparing the systems is that the maximum flue temperature on coke oven plants is lower than the maximum combustion chamber temperature on horizontal settings for the same internal temperature, because of the reversible system of heating.

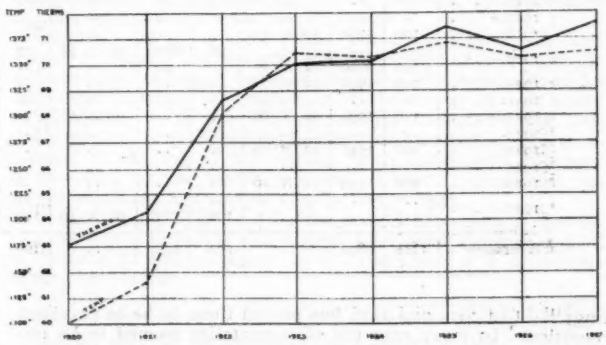


Chart D.—Showing Relation between Therms per Ton and Working Temperature.

For the result of alterations in design, we have to wait patiently; but it is hoped that settings at Beckton built within the last two or three years will give considerably over 2000 days' life and a coal tonnage exceeding 3400 per retort in 20-ft. retorts, and 4000 in 23-ft. retorts.

A special examination, from the combustion chamber, of set-

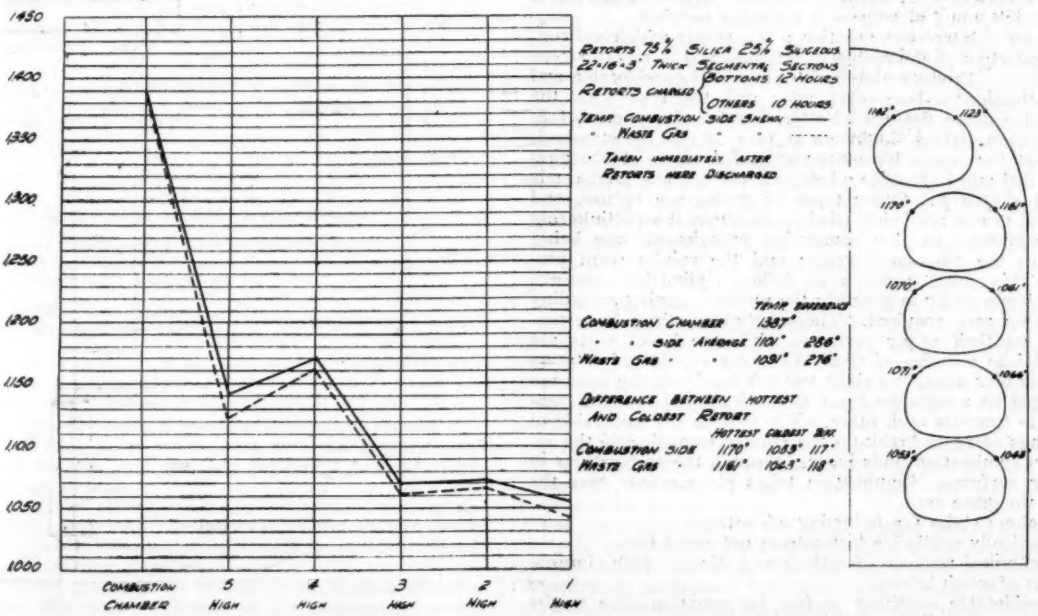


CHART C.—SHOWING DISTRIBUTION OF HEAT (NO. 2 RETORT-HOUSE, MARCH 31, 1924).

TABLE B.—*Numbers, Dimensions, and Length of Life of Retorts from* 1914-1927.

Year.	A.			B.			C.			D.			E.		
	No.	Age.	Size.	No.	Age.	Size.	No.	Age.	Size.	No.	Age.	Size.	No.	Age.	Size.
			In.			In.			In.			In.			In.
1914. . .	300	1480	22 × 15	..	..	..	100	1250	22 × 15	..	..	..	..	..	..
1915. . .	300	1860	22 × 16	..	..	..	..	..	..	..	..	..	..	..	..
1916. . .	100	1450	22 × 16	..	..	..	100	1450	22 × 16	..	..	..	..	..	..
	320	1850	24 × 18	10	1850	24 × 18	110	1850	24 × 18	..	..	..	..	..	..
1917. . .	..	..	..	..	..	..	..	..	..	20	1450	22 × 16	80	1450	22 × 16
1918. . .	100	1780	22 × 15	..	..	..	..	..	..	..	..	..	..	..	..
	125	1950	24 × 18	..	..	..	125	1950	24 × 18	50	1950	24 × 18	..	..	..
1919. . .	113	2044	24 × 18	..	..	..	90	2044	24 × 18	..	..	..	80	2044	24 × 18
	..	..	..	..	..	..	150	2080	22 × 16	..	..	..	..	..	..
1920. . .	..	..	..	..	..	..	200	1990	22 × 16	..	..	..	..	..	..
1921. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1922. . .	180	1660	22 × 16	10	2100	22 × 16	166	1788	22 × 16	..	..	..	..	..	..
1923. . .	432	2100	24 × 18	..	..	..	270	536	24 × 18	..	..	..	..	..	..
	100	1016	22 × 16	..	..	..	190	1016	22 × 16	2	1016	22 × 16	..	..	..
1924. . .	100	1540	22 × 16	..	..	..	..	..	..	..	..	..	..	..	..
	400	1444	23½ × 16½	..	..	..	..	..	..	..	..	..	..	..	..
1925. . .	200	1948	24 × 18	..	..	..	100	1948	24 × 18	..	..	..	..	..	..
1926. . .	20	1933	22 × 16	..	..	..	..	..	..	..	..	..	..	..	..
1927. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Average .	2790	1756	..	20	1975	..	601	1524	..	72	1785	..	160	1747	..

TABLE B.—(*Continued*).

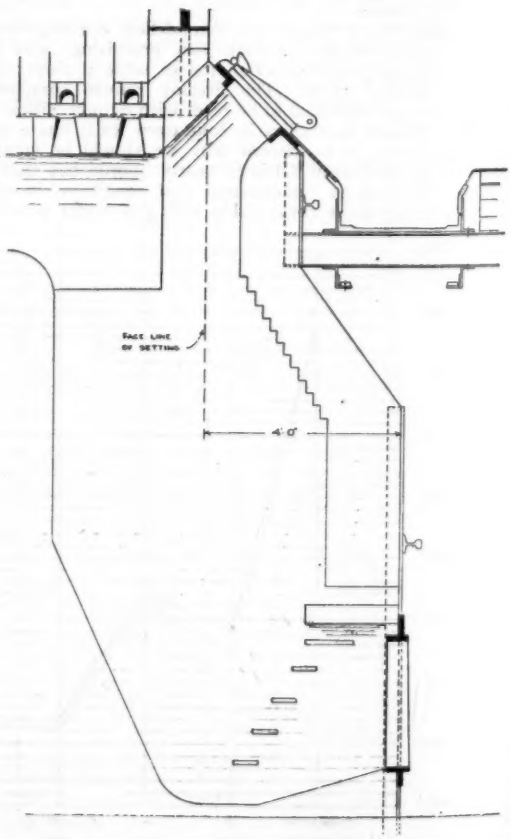
Year.	F.			G.			H.			J.			K.		
	No.	Age.	Size.	No.	Age.	Size.	No.	Age.	Size.	No.	Age.	Size.	No.	Age.	Size.
			In.			In.			In.			In.			In.
1914. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1915. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1916. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1917. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1918. . .	100	1780	22 × 15	..	..	..	..	..	..	..	..	..	..	..	..
1919. . .	..	..	..	30	2044	24 × 18	17	2044	24 × 18	70	2044	24 × 18	..	..	..
	150	2020	22 × 16	..	..	..	..	..	..	..	..	..	..	..	..
1920. . .	100	1990	22 × 16	..	..	..	..	..	..	..	..	..	..	..	..
1921. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1922. . .	538	1990	22 × 16	..	..	..	..	..	..	..	..	..	..	..	..
1923. . .	..	..	..	..	..	..	..	..	..	..	..	..	8	2100	24 × 18
1924. . .	200	1540	22 × 16	..	..	..	..	..	..	..	..	..	..	..	..
1925. . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1926. . .	200	1933	22 × 16	..	..	..	..	..	..	..	..	..	80	1933	22 × 16
1927. . .	..	..	..	..	..	..	..	..	..	..	..	..	270	1069	24 × 18
	..	..	..	100	1272	22 × 16	100	1272	22 × 16	..	..	..	100	1272	22 × 16
Average .	1288	1896	..	130	1450	..	117	1384	..	70	2044	..	458	1282	..

tings built in 1925 and 1926 has proved these to be in excellent condition. In every case the silica material seemed to be unaltered in appearance and shape, except that a few of the retort segments were cracked between the division walls. This is probably due to contraction in cooling-down and the refusal of the segments to slide on the division walls and return to their original position. In one setting, where the retorts were supplied by two makers, the writer measured the cracks, and found in one instance that they amounted to 11 mm., and in the other to 13 mm., in 18 ft. of silica. It was assumed that the cracks would close-up at working temperatures; and no attempt was made to fill them with jointing cement. Cracks appeared in the main arches and pier walls in a similar position.

It may be of interest to mention a few points which are considered important in the design of settings, and to record recent modifications. Producers at Beckton received considerable and careful attention a few years ago; and the type with the Beckton step grate, described by Mr. Leech in his paper before the Institution of Gas Engineers in 1922, is still the standard, except that the fronts have been extended to assist charging with hot fuel and to provide a better fuel bed. The producer is shown in sketch A. Other types of grates are in use, and mechanical grates are being tried to ascertain if self-clinkering can be adopted. In this connection experiments are being made with the Sauvageot grate; and the results seem promising. This grate consists of hollow cylindrical castings arranged horizontally in parallel; the number varying according to the grate area required. These hollow castings have perforations on their upper surfaces, while the lower parts are developed into a series of ribs. They are capable of rotation about their own axes, and right and left hand worm wheels are so arranged on a common shaft at the front end that the castings rotate towards each other. The ribs on the underside of the castings serve to break-up the clinker formed, and the air to support combustion finds ingress through the perforations in the upper surfaces. Combustion takes place evenly over the whole of the grate area.

The makers claim the following advantages:

(1) Practically negligible losses from unburned fuel.
(2) Mechanical removal of all ash and clinker, with elimination of much labour.
(3) Considerable economy in fuel consumption, due to the enhanced quality and uniformity of producer gas.



Sketch A.—Beckton Type Producer: Front Set Forward.

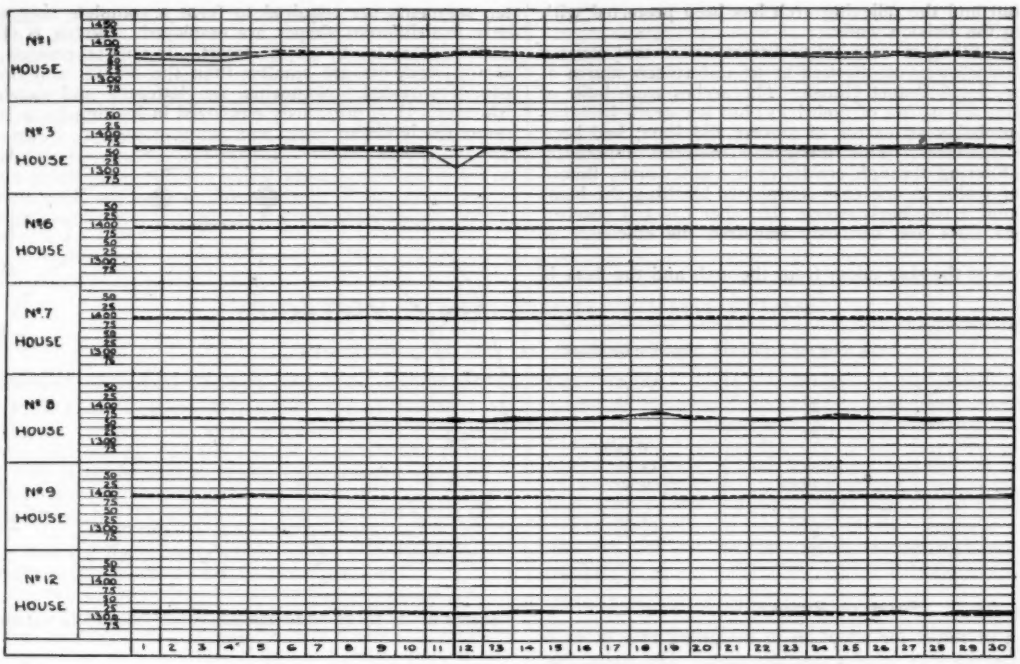


CHART E.

It is generally accepted that the nostril blocks in the producer arch should be of silica, but at Beckton, with a deep fuel bed, and consequent low temperature in the producer, a good fireclay is considered more suitable. Where silica is used in the arch, very great care has to be exercised in lighting-up and cooling down; and where it is necessary to maintain the temperature of a setting with cold fuel, special precautions should be taken to ensure that the fuel is reasonably dry.

The relining of producers to a height of about 5 ft. 6 in. is generally done at Beckton on Sunday between 6 a.m. and 4 p.m. when gas-making plant can be spared, and the sudden cooling to which the furnace arch is subjected would be very detrimental to silica. The temperature drop in the combustion chamber is not sufficiently great to cause spalling.

In preparation for relining, the fuel bed is allowed to burn down from about 10 p.m. on Friday, and retorts other than those required for re-fuelling the producer after relining are charged and discharged till about 6 a.m. on Saturday. Fires are raked-out on Saturday afternoon, and, with the individual dampers on the settings closed, the temperature of combustion chambers does not fall below 1200° C., while the producer is cool enough for men to work in. The work of cutting-out and relining is done by two bricklayers and two labourers per furnace. At 4 p.m. producers are filled with hot fuel, and normal conditions are resumed within 48 hours. Relining is usually necessary after 18 months' work; and when settings have to be let out for furnace repairs, the cost of lighting up with cold fuel is a considerable item.

The following comparative costs indicate the economy of our method of relining while the settings are maintained at carbonizing temperatures:

	£	s.	d.
(1) Relining during Sunday—material for 30 producers	85	0	0
Labour—2 bricklayers, 2 labourers per furnace; working time, 10 hours	215	0	0
	£300	0	0

£10 per furnace.

	£	s.	d.
(2) Relining when settings are cold—materials for 30 producers	85	0	0
Labour—1 bricklayer, ½ labourer per furnace; working time, 4 days	175	0	0
Fuel for heating-up settings—270 tons at 21s. per ton	283	10	0
Labour filling fires—labourers	27	0	0
,, cleaning fires—firemen	9	7	6
	£579	17	6

£19 6s. 7d. per furnace.

In order to prevent leakage, producer arches are covered with ½-in. splits. Nostril holes are tapered with the greatest cross section at the bottom, and they are increased in size towards the fronts of the setting.

The advantages of setting retorts in two vertical tiers are no longer disputed; and with the Beckton setting of ten retorts there is no difficulty in maintaining perfectly steady temperatures in the combustion chambers.

Chart E shows the monthly record of combustion chamber temperatures. Movement observed in the combustion arches has recently led to the introduction of an arch of stronger design, which is now standard for all settings, irrespective of the pier wall centres or the size of retorts.

Secondary air ports are raised above the nostril blocks, and the air is directed into the producer gas stream at such an angle as to produce as long a flame as possible. The admission of an additional supply of air higher up in the setting is now under consideration, with the idea of partially consuming the producer gas in the combustion chamber, and completing the combustion at the top of the setting, with consequent increased temperature on the waste gas side. Chart C, previously referred to, shows the uneven distribution of heat.

There is much to be said for the reversible heating system as practised in coke ovens, and designs for similar systems applied to horizontal settings figure in the literature of a prominent coke-oven builder.

Various methods of construction in retort settings have been suggested and used to counteract the effects of after-expansion. Whatever may be the merits of such proposals, their use as a policy is unsound and unnecessary to-day. In the early days of silica, when setting temperatures exceeded a point beyond that reached by the manufacturer in his kiln, some device was necessary to combat the inevitable growth which took place in the combustion chamber walls at 1400° to 1420° C. but did not take place in the walls on the waste gas side of the retorts, where the temperatures graduated from 1240° to 1000° C. It is this difference between the temperatures on either side of the retort which made the provision for growth in the past so uncertain and unreliable. With correctly burnt silica ware, consisting mainly of crystobalite with smaller quantities of tridymite, permanent expansion is absent. The greater part of the ordinary expansion occurs at the very low temperature of 230° C. While it is true that fireclay is sufficiently refractory to function on the waste gas side of the retorts, where the temperature graduates from 1240° to 1000° C., the sudden expansion of the silica in the combustion chamber at 230° C., which is not shared by the fireclay, will distort the work and may open the joints, in addition to breaking the bond of the cement with the surfaces, either of which will prove troublesome later by developing into holes.

Expansion should take place equally throughout the setting. All-silica material from the bottom retort upwards is essential to ensure this. The allowances for expansion should be made about the periphery of the silica work adjacent to the pier walls and the main arch, and not within the built-up work itself. It is emphasized that in the construction of the setting the closer the approach to a monolithic whole the better. To this end, joints should be as thin as the surface of the shapes allow. Open work and partially filled joints should be avoided at all costs.

Seating blocks shaped to the retort segments are built into the division walls to provide proper support for the bottom corner tile, but these blocks do not extend from wall to wall to form a shield for the retort.

The springing line of the main arches is raised by 3 in. towards the centre of the bench, to allow for settlement, which usually occurs, curtailing the flue space over the top retorts. Where such settlement has taken place, rather than face the expense of re-building the arches, the 9-in. arch blocks have

been taken out and the relieving arch has been protected with tiles spanning the division walls.

The need for filling-in with old firebricks for several courses above main arches was emphasized by an unforeseen source of failure in our No. 6 Retort House. The arches were built of two rings, 9 in. and 4½ in., of firebricks; but low-grade building bricks, and probably an excess of mortar and lime, had been used in the spandrils. This low-grade material apparently fluxed, and, filtering through cracks in the main arch, flowed down the pier walls, in one case completely blocking the heating space round a two-high retort. In other cases it reached the waste gas flues and seriously impaired the efficiency of regeneration.

The analysis of the slag taken from the arch and the flues is given below:

—	Slag from the Arch.	Slag from the Flues.
SiO_2	52·11	50·98
Al_2O_3	20·45	22·87
Fe_2O_3	7·67	8·97
FeO	1·23	..
Fe	..	1·12
CaO	13·57	13·76
MgO	1·78	0·40
K_2O	1·11	0·46
Na_2O	0·75	1·44
TiO_2	1·47	0·70
SO_3	0·32	..

Shape of Retort.

The section of retort for adoption in designing new plant is one which deserves very careful consideration. The writer has practically no experience with oval retorts, but observation of an experimental setting leads him to believe that a better gas yield per ton of coal might be expected than from the Ω section.

In 1924 a special setting was built in No. 4 Retort House with four oval retorts 21 in. by 15 in. on one side of the combustion chamber, and four Ω retorts 24 in. by 18 in. on the other. The retorts were fitted with double ascension pipes and with Tipper anti-dip valves; and separate hydraulic mains were provided for the Ω and the oval. In this way the gas could be collected from either section; and it was exhausted, purified, and tested in the coal testing plant. Retorts were charged by a De Brouwer machine, which also operated 29 settings of tens in the same retort house; and much difficulty was experienced in the measurement of coal. The 5-ton hopper on the machine had to be emptied before charging the special retorts, and a weighed quantity of coal, equal to the charge, fed through the machine.

The results varied somewhat, but so conclusive were they in favour of the shallow retort that it was decided to alter the 24 in. by 18 in. section to 24 in. by 16 in. throughout the works, and thus reduce the thickness of coal in the retort while maintaining a charge which occupied the same proportion of the available space. An interesting feature was the lower free-carbon content of the tar produced from the oval retort; and this is reflected in the figures obtained from No. 1 House, which is the only one available for comparison.

House.	Retort Section.	Free Carbon.
		P.Ct.
1	24 in. by 16 in.	9·1
2	22 ,, ,, 16 ,,	13·1
4	22 ,, ,, 16 ,,	10·2
5	22 ,, ,, 16 ,,	12·2
9	24 ,, ,, 18 ,,	11·6

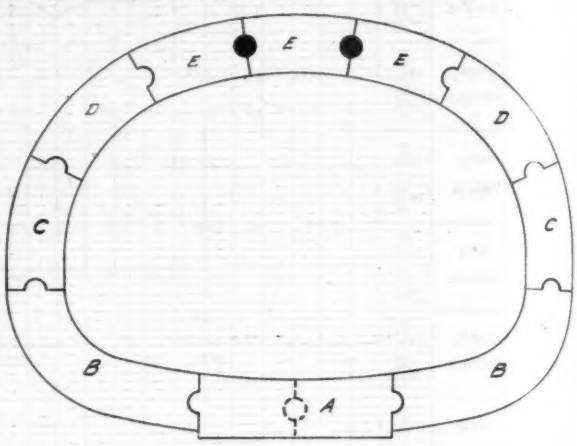
Where the section has been altered, in order to utilize the existing mouthpieces, a special clay piece was designed, tapering from 24 in. by 18 in. to 24 in. by 16 in.

Incidentally the increased size of the mouthpiece over the retort assists greatly in pushing "full" charges; and where a coke stop is left in the mouthpiece—as is our practice with projector machines—a free gas way to the ascension pipe is assured.

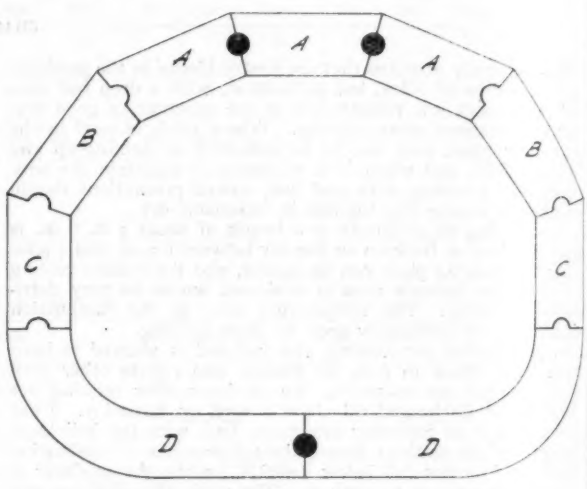
If engineers could decide upon a standard section of retort, manufacturers would be able to quote cheaper prices, because of the economy that would be effected in the cost of moulds. One manufacturer calculates that the saving would be at least sixpence per foot, and points out that, in the smaller works, where mould making is a very considerable item, the saving would be greater. Another advantage of standardization would be that sections could be kept in stock, and works would therefore get quicker deliveries.

A standard section might even lead to the introduction of machines for moulding, though it is often claimed in this country to-day that hand-made shapes are preferable to machine-made. In Germany machines are more generally used than in this country.

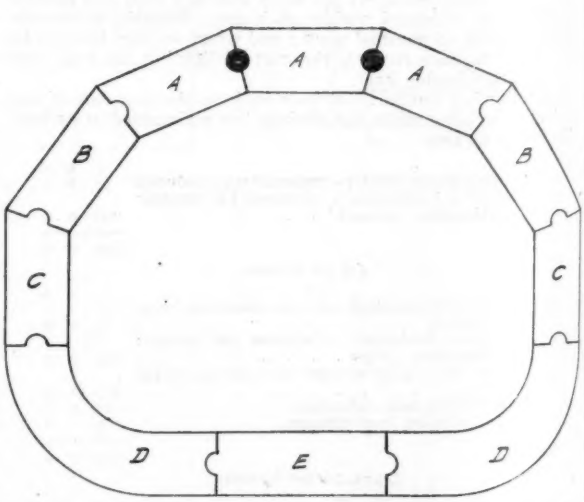
For simplicity in manufacture, and in order to reduce the number of shapes, it has been finally decided to have tongue and groove joints with plain joints on the butt ends. Though ten segments are required to form a complete ring of retort, only five different shapes are employed. Sketch B shows the section of 24 in. by 16 in. retort. It will be noticed that the crown segments are smaller than the others, and that a key tile is provided. Segments are lettered, and much of the labourer's time previously employed in looking for a particular retort tile is saved.



Sketch B.—24 In. by 16 In. Section Retort (Two-Piece Bottom shown Dotted).



Sketch C.—22 In. by 16 In. Square Section Retort (Two-Piece Bottom).



Sketch D.—22 In. by 16 In. Square Section Retort (Three-Piece Bottom).

It is advisable to have joints in the bottom of the retort as far away from the combustion chamber as possible; and the only modification likely to be made in the present design is the building-up of the retort bottom with two tiles instead of three. This modification was discussed with retort makers in 1926, and five experimental settings have been built this year.

If it were possible to mould, burn, and handle silica in larger pieces, it would be preferable to have the bottom of a complete

ring made in one piece. One retort maker is attempting to make such a section.

The smaller retort, 22 in. by 16 in., is now made in what might be called the "square" section. Sketch C shows the "square" section with two-tile bottom, and sketch D shows it with three-tile bottom.

This retort is cheaper to make and easier to build, and fewer special bricks are required in a setting. Where clay ends, 2 ft. long, were previously used, the silica retort is now extended on to the front wall, and only sufficient length of clay employed to hold the cast-iron collars to which the mouthpieces are bolted. The increased conductivity of the silica is noticeable here, and longer charges can now be carbonized. No difficulty has been experienced with the silica spalling.

It would have been possible with clay ends 2 ft. long to make a reducing piece, but the difficulty of making a short clay piece tapering from 24 in. by 18 in. ⌂ section to 24 in. by 16 in. "square" section prevented the adoption of the "square" section for the 24 in. by 16 in. retort, and it was considered better to sacrifice constructional advantages in shape to gain the advantages of longer charges.

(To be continued.)

COOKERY AND FOOD EXHIBITION.

Prominence of Gas at Holland Park Hall.

The Thirtieth Universal Cookery and Food Exhibition, in Holland Park Hall, London, W., which was opened by Lady Mary Crichton (wife of the Deputy Controller of the King's Household) on Nov. 15, and will remain open until to-morrow, Nov. 24, may fairly be said to constitute a triumph for gas, in view of the satisfaction expressed by demonstrators with the cookers installed for the purpose by the Gas Light and Coke Company. In one instance it was, we are informed, specially stipulated that for the cooking of the national dishes of a certain country a gas stove should be provided.

The Universal Cookery and Food Association, which was instituted to "spread a better knowledge of the various substances used as food, and the best and most economical methods of cooking," has as its Chief Patroness Her Majesty the Queen; while included among the Patrons is Sir David Milne-Watson, LL.D., D.L. The President is the Hon. Sir Derek Keppel, G.C.V.O., C.M.G., C.I.E. Mr. F. W. Goodenough, C.B.E., is a Vice-President; and the Chairman of the Association is Mr. J. E. Henwood. Mr. H. H. Hoyt, as Secretary of the Association and Organizing Secretary of the Exhibition, has done excellent work, as also have Mr. J. Odone as Chairman of the Commercial Group and Miss M. L. Norton (assisted by Miss I. M. Senn) as Chairman of the Domestic Section. In the latter group, too, many readers are well acquainted with the name of Miss E. Willans. The Chairman of the Army, Navy, and Air Force Cookery Group is Lieut.-Col. Stephen Wright, O.B.E., who last September completed 46 years' service in the Army (many of them in the important position of Inspector of Army Catering), and whose work for the Association was recognized by the presentation to him of a piece of plate by Mr. Henwood at the recent annual dinner. The several other groups are similarly well served.

Various competitive demonstrations have been organized by Mr. B. J. Morrow, of Woolwich Arsenal, who has devoted much time to securing for visitors demonstrations of all sorts and descriptions. Everywhere there are hints to be picked up by the housewife; and even the catalogue contains a selection of recipes for good home cooking, presented by Mr. C. Herman Senn, as well as a series of menus and recipes which a number of well-known chefs have contributed. At the opening luncheon, Major Isidore Salmon, C.B.E., M.P. (Chairman of the London County Council Committee for the Training of Boy Chefs and Waiters) responded to Mr. Henwood's toast of "Success to the Exhibition."

Visit of the Duchess of York.

A visit was paid to the exhibition, on Thursday last, by Her Royal Highness the Duchess of York, who (accompanied by Sir Derek Keppel, and conducted round by Mr. Henwood) spent more than an hour inspecting the exhibits, in which she manifested keen interest.

Since the establishment of the Technical School for Cooks some fifteen years ago by the London County Council, the school has been represented, with the exception of last year, at all the exhibitions. A number of the school's selected pupils display their culinary skill daily; and simultaneously with this, pupils of the Waiters' School demonstrate the art of waiting at table. There is a full working kitchen, in which the whole of the cooking for over 200 meals a day is being done by gas. To quote figures, the quantity of gas used during three days in this kitchen was 21,800 c.ft., and the number of meals served approximately 740. This school was naturally a source of interest to the Royal visitor, as were the Army and Navy cookery demonstrations, the details of which were explained by Col. Wright. There are in the exhibition two demonstration kitchens, and one for the Army and Navy cooking competition. In all of these gas is being used for cooking, water heating, &c. Special encouragement is given to professional cooks, housewives, and amateurs to take an active part in various competitions, which embrace artisan, household, and high-class cookery, together with other appropriate subjects.

The competitions include invalid cookery and hospital dietary; and the Duchess of York, seeing the various trays submitted, in these and other sections, remarked that there was no doubt the exhibition and the Association were doing most valuable work in educating all sections of the public in the importance of good food and good cooking. As a matter of fact, the number of entries this year approaches 1500; and substantial prizes are offered. Among the donors are the Gas Light and Coke Company, who contribute £50 for prize medals, &c., for economical cookery.

Some of the Exhibits.

The Gas Light and Coke Company have a model kitchen, well arranged with a cooker, geyser, coke boiler, circulator, and other modern appliances utilizing gas. In an adjoining room is shown a further selection of gas cookers, gas fires, and geysers. The gas lighting of the stand is operated by distance control switches. On reaching this exhibit, the Duchess of York recalled the fact that Mr. Henwood had shown her round the gas exhibit at Wembley, the many interesting features of which she remembered.

Among the commercial exhibits, Messrs. W. M. Still & Sons, Ltd., display coffee making apparatus, automatic gas toasters and grillers, dish washing machines, &c.; and Jackson Boilers, Ltd., their patent café fountain boiler, gas still-room set, and other specialities. A particularly tasteful display was made by Electrolux, Ltd., drawing attention to their refrigerators. With these our readers are already familiar; while the Company's new water softener is referred to on another page in connection with the Public Works, Roads, and Transport Congress Exhibition.

Extensive preparations had to be made for the exhibition. In connection with the water supply, Messrs. Thomas Potterton fixed 3000 ft. of barrel; while 2000 ft. were installed by the Gas Light and Coke Company for gas supply. Altogether Messrs. Potterton have provided four sets of "Victor" complete apparatus for furnishing hot water; and the Gas Light and Coke Company have installed 35 cookers, together with over a score of gas-consuming appliances of other kinds.

Empire Marketing Board.

A feature of the exhibition is the display of the Empire Marketing Board, which comprises a demonstration of the methods employed by them in their policy of participation in a number of selected exhibitions in the United Kingdom, with a view to increasing the sale of Empire-grown foodstuffs (from home and overseas) in this country. The space taken by the Board is allotted to the Dominions and Colonies according to their individual requirements; and the combined display is, in fact, a miniature exhibition of the food products of the parts of the Empire represented.

The general publicity in the Press, which has been particularly good, has been conducted by Mr. Kenneth Blundell, of Westminster Exhibitions, Ltd.; and by the efforts of all responsible for the staging of the exhibition, from the Chairman (Mr. Henwood) downwards, the objects of the Association must be appreciably forwarded.

Wireless and Gas-Pipes.—The "Liverpool Post" for Nov. 8 says: "The necessity of always switching a wireless aerial to earth after using the set and keeping both aerial and earth clear of gas-pipes was emphasized by a Liverpool expert, yesterday, with reference to the explosion at Lisburn Lane, caused by lightning striking a wireless aerial and coming into contact with a gas-pipe. It has always been an unfortunate habit with some wireless listeners," he said, "to choose the nearest gas-pipe for their earthing system. A water-pipe is not only much safer; but it has the advantage of making a better earth."

Gas in a Large Restaurant.—No. 164 of "A Thousand-and-One Uses for Gas" is an illustrated account of the extensive gas equipment in the new £250,000 restaurant of Messrs. S. Reece & Sons, Ltd., at Liverpool, where 1750 people can be catered for at one time. The building has one chimney only, and this is smokeless, for no coal is used.

PUBLIC WORKS, ROADS, AND TRANSPORT.

CONGRESS AND EXHIBITION.

There was staged last week—from Nov. 14 to Nov. 19—at the Royal Agricultural Hall, Islington, N., the fourth biennial Public Works, Roads, and Transport Exhibition; and in connection therewith a number of papers were discussed on subjects relating to important phases of local government work, and the various public services undertaken by local authorities. The papers were by experts in the different matters dealt with; and several made close appeal to "JOURNAL" readers. From them good results may fairly be anticipated; while the exhibition afforded practical demonstration of the present-day importance of road and transport problems.

The opening was marked by a luncheon, which was presided over by Sir HENRY P. MAYBURY, K.C.M.G., C.B. (Director-General of Roads, Ministry of Transport), who acted as Chairman of the Organizing Committee of the Congress and Exhibition. He remarked that the present fixture promised to be the most successful of the series, which were inaugurated in 1915, on a very small scale in Westminster. Nearly 2000 delegates would be coming to attend the meetings.

IMPORTANCE OF ROAD PROBLEMS.

At the present day, said Sir Henry, road problems were most important. They were spending on roads millions of pounds a year. There were some 287,000 miles of roads, vested in 2000 local authorities; and he claimed that they had reasonably good surfaces—probably the best road system in the world, and one that contributed largely to the welfare of the community. There had been some criticism on the question of the construction of new roads. Since 1920 they had constructed about 200 miles of new arterial roads in the London area, and he supposed an equal number of miles in the provinces; and upon this work there had been expended upwards of £30,000,000 sterling. This work was put in hand primarily to relieve the problem of unemployment; and it was gratifying that, not only did they in this way find work for those who were unfortunately stranded, but they had created a lasting asset for the country. Continuing, he said he wished everyone to be imbued with a spirit of optimism. As a result of the present conference, he was hopeful that they would see a Chair of Highway Engineering established at the University of London.

THE EXHIBITION.

The exhibition must have proved invaluable to municipal engineers and surveyors, and all engaged in public works; for every available inch of space was occupied by exhibitors of the latest developments in engineering and other trades which supply the special requirements of county, municipal, urban, and other authorities. It is possible to mention here only a few of the great number of interesting things that were to be seen—a large proportion of which had naturally to do with road making.

In this category, reference may first of all be made to the excellent display of the British Road Tar Association, of 17, Grosvenor Gardens, London, S.W. It was pointed out that British coal tar can justly claim to have been the earliest of modern road-surfacing materials. Hundreds of miles of road exist throughout the country which many years ago were made with tar macadam or surfaced with tar, and which continue to give complete satisfaction. The main theme of the display was to demonstrate the use of tar in all its phases for road making. Samples of No. 1 and No. 2 Road Board Tars, together with tar emulsions, used respectively for the surface dressing, surfacing in the form of tar macadam, and cold dressing and patching of roads, were shown; and there were aggregates in the tarred and untarred state, as well as experimental sections of roads constructed in tar.

A feature of particular attraction was a tar viscosity demonstration apparatus; and there were set out for inspection by those interested Hutchinson's tar tester for consistency and Hutchinson's gravity gauge and hydrometer—the latter for the use of foremen. These instruments, both of which are specified by the Ministry of Transport, are made by Hutchinson's Testing Apparatus, Ltd., of 21, Great Peter Street, Westminster, S.W. There was also apparatus for distillation testing, by Messrs. Baird & Tatlock (London), Ltd., of 14-15, Cross Street, Hatton Garden, London, E.C.

A number of photographs illustrated roads constructed of all-British materials; while the visitor read that "British tar forms non-skid roads."

GAS LIGHT AND COKE COMPANY.

A particularly bright spot in the gallery was provided by the Gas Light and Coke Company, who had a model kitchen fitted with the latest labour-saving and comfort-making appliances. In a tiled recess were a "Standard" cooker, a Wright's "Vandyke" fire, with a Davis "Burn-All" incinerator. A Potterton's "Builders' Set," an "Eco" gas drying cabinet, and a Cannon "Corna" wash copper completed this portion of the exhibit. In the living room were Davis "Medusa" and "Canopus" fires; while the lighting was by Sugg "Directive" lamps, switch controlled, and "Silglas" standards. In the front a smoke abatement section emphasized the dirt and waste resulting from the consumption of raw coal.

OTHER GAS EXHIBITS.

Gas mantles of all types for street lighting and public works were shown by Imperial Chemical Industries, Ltd., of Nobel House, Buckingham Gate, London, S.W.

The Horstmann Gear Company, Ltd., of Newbridge Works, Bath, exhibited a complete range of "Newbridge" automatic gas controllers and electric time switches for public lamps. The gas section comprised a complete range from their low-priced type for square lanterns, and other more refined models for similar lanterns, up to ironclad controllers with the largest possible gas ways for the biggest gas lamps made. In addition to plain on-and-off controllers and time switches, the Company make a speciality of controllers with compound actions, which are useful for further reducing the cost of public lighting. After about midnight, it is not necessary that the streets should be so brilliantly illuminated; and the lighting authorities of many large cities and towns are ordering Horstmann checking controllers and time-switches with a view to reducing their consumption of gas and electricity.

Metropolitan Gas Meters, Ltd., of Hyson Green Works, Nottingham, gave demonstrations of their "Duplex" clockwork controllers for street lighting. In these, the by-pass is cut-out during lighting hours. They also had on view ordinary, stop action, and prepayment gas meters.

A gas heated boiler of 200 gallons capacity for tar or bitumen was a feature of the stand of Messrs. Thomas Coleman & Sons, Ltd., of Alfreton Road, Derby. It is named the "Depot," and is a serviceable piece of plant.

MISCELLANEOUS.

The Anglo-American Oil Company, Ltd., of 36-38, Queen Anne's Gate, Westminster, S.W., were exhibiting the various grades of standard bitumen which they market, and which are made in this country by British labour. The exhibit was illustrated by a number of photographs of the roads laid down with this standard bitumen. A further exhibit by them was the standard safety line. These lines are now being used extensively for marking the roads in the interests of traffic control. There was an interesting model showing the combination of standard bitumen and standard safety lines for road purposes.

A display of tools and appliances for public works contractors, by Messrs. Abbott, Birks, & Co., of 113, Newington Causeway, London, S.E., included gas and water main drilling and tapping apparatus, with which pipes can be drilled and tapped at one operation without loss of gas. In a large assortment of mainlaying requisites were gas bags and expanding stoppers for mains, together with pipe benders and cutters and caulking tools.

Weldless steel gas and water mains are manufactured by the Bromford Tube Company, Ltd., of Birmingham, who showed these and other of their specialities. This firm make also lamp standards for gas and electricity, boiler tubes, &c.

An interesting appliance is the "Hi-Lift" loading shovel of the Chaseside Engineering Company, of Chaseside, Enfield, London, N. The shovel is built on to a "Fordson" tractor, and is the latest development of the application of the "Fordson" to every-day needs. It is adaptable to a variety of uses, and is sturdily built—being designed to work day after day on heavy work. The scoop is of one half-yard capacity, and tips at a maximum height of 9 ft. The controlling gear is simple and foolproof; and all wearing parts are easily replaced when worn. The lifting and dropping of the scoop is controlled by a single lever. Photographs were displayed of the shovel in operation at, among other places, the works of the Brighton and Hove General Gas Company and the Manchester Corporation.

The new "Electrolux" water softener is a simple way of employing the well-known base-exchange method of softening water for domestic purposes. It can be fitted in a moment to any water tap in the house. No plumbing work or other mechanical aids are necessary to do this. It is attached as easily as a garden hose, and will deliver pure soft water indefinitely, subject to simple "regenerating" periodically. This, and their well-known refrigerator, were shown by Electrolux, Ltd., of 153-5, Regent Street, London, W.

For the purpose of reinforcing tar and bituminous macadam surfacing to roads, paths, and the like, "Expamet" reinforcement has been used in various places during the past few years;

and, speaking generally, experience gained goes to show that entirely satisfactory results, from all points of view, can be obtained. Progress reports state that the method is easy of construction, as well as successful in practice. "Exmet" reinforcement for brickwork, concrete-block work, concrete kerbing, &c., is machine made and of meshwork formation. It has no joints, no welds, and no loose or separate strands or attachments; the junctions between the meshes remaining uncut in the process of manufacture. Thus all the strands or members are connected rigidly, and have continuous fibres throughout the strip or sheet. "Expamet" and "Exmet" are specialities of the Expanded Metal Company, Ltd., of York Mansions, Petty France, Westminster, S.W., who showed them at the exhibition.

A large selection of apparatus was on the stand of Messrs. Guest & Chrimes, Ltd., of Rotherham. A small standard Venturi tube was shown under working conditions operating various indicators and recorders. Sluice valves, a sample of which was to be seen in section, are made by the firm in all sizes.

Messrs. Holman Bros., Ltd., of Camborne, and Messrs. Reavell & Co., Ltd., of Ranelagh Works, Ipswich, had on their stands portable compressor sets, among other exhibits.

Mangnall-Irving Thrust-Borer.

The Mangnall-Irving thrust-borer has been adopted in a large number of places. It is a hydraulically operated machine for boring under roads, railways, canals, buildings, &c., for the purpose of laying pipes or cables.

A complete equipment was arranged on the stand of the Hydraulic Engineering Company, Ltd., of Chester. A new safety device was demonstrated, to show how an alarm is given should an existing underground gas or water pipe or electric cable be encountered while boring, thus preventing any chance of damage. Briefly, the operation of thrust-boring is as follows: Small pits are made in the ground at a suitable distance apart. A machine is placed in one of them, and, by means of a scientifically designed equipment, a bar of special formation is thrust into the ground, at the desired line and elevation. This bar, in turn, is thrust ahead by the addition of further rods, until the full length is completed. The ground is compressed. There is no cutting action, and consequently no spoil.

Various types of Venturi recorders were exhibited by Messrs. George Kent, Ltd., of Biscot Road Works, Luton, together with a complete range of semi-positive and positive water meters, air meters, &c.

Messrs. Lunt Bros. (Quarry Owners), of 13, Colmore Row, Birmingham, who had a comprehensive stand, are suppliers of road materials, including "Exlunmac" tarred limestone, made at Ruthin Quarry. The firm also supply silica and fireclay; and they are agents for various gas coal and other collieries.

Messrs. Stothert & Pitt, Ltd., of Bath, showed various special types of plant manufactured by their mixer department.

Elsewhere Messrs. Thomas & Bishop, Ltd., of 37, Tabernacle Street, London, E.C., drew attention to their "Permac" jointing material, the efficiency of which was practically demonstrated by the lowering of joints into an illuminated water-filled tank; air compressed to a pressure of 100 lbs. per sq. in. being applied.

The only other display calling for special mention here is that made by the Victualic Company, Ltd., of King's Buildings, Dean Stanley Street, Millbank, London, S.W., who showed the "Victualic" joint, which, being flexible under pressure, enables a pipeline to accommodate itself to ground movement, remaining absolutely tight.

The "Victualic" joint is of extremely simple construction, and can be easily and rapidly fitted. Vibration does not impair its efficiency; and its flexibility under pressure presents a considerable advantage for use on mains to be laid under roads over which passes heavy modern vehicular traffic. There being a gap between each element, every joint absorbs the expansion or contraction of its own pipe length. The joint is used for water, gas, compressed air, oil, benzole, tar and pitch, &c.—in fact, for practically everything except steam.

STREET LIGHTING.

On Tuesday morning, Nov. 15, there was a conference under the auspices of the Incorporated Municipal Electrical Association and the Institution of Gas Engineers, under the Chairmanship of Sir Joseph Petavel, K.B.E., D.Sc., F.R.S., Director of the National Physical Laboratory, Teddington, at which the following two papers were presented:

"Street Lighting regarded as an Illumination Problem," by Mr. J. W. T. Walsh, M.A., D.Sc., A.M.I.E.E., F.Inst.P., Senior Assistant, Photometric Division, National Physical Laboratory, Teddington.

"Street Lighting of London," by Mr. W. J. Jones, M.Sc., A.M.I.E.E., Engineer, Electric Lamp Manufacturers' Association of Great Britain.

Mr. Walsh's paper was awarded the second prize in the open competition organized by the Congress Committee.

Details of these papers, and a report of the lengthy discussion to which they gave rise, must be held over for inclusion in a subsequent issue of the "Journal."

GAS INDUSTRY'S CONTRIBUTION TO SMOKE ABATEMENT.

On Tuesday afternoon there was a conference arranged by the Institution of Gas Engineers, with Mr. H. D. Madden, M.Inst.C.E., of Cardiff (the President), in the chair, to consider a paper entitled:

"The Gas Industry's Contribution to Smoke Abatement," by Mr. F. W. Goodenough, C.B.E., Executive Chairman of the British Commercial Gas Association.

[See "Journal" for Nov. 16, pp. 465-9.]

Unfortunately, Mr. Goodenough was unable to attend in person to present his paper; but this was done on his behalf by Mr. W. M. Mason (Manager of the "B.C.G.A."). There were also on the platform supporting the Chairman, Mr. W. E. Price, Mr. H. C. Smith, and Mr. W. T. Dunn.

The Chairman, in opening the proceedings, said he had to apologize on behalf of Mr. Goodenough for his absence. Mr. Goodenough had written: "I am exceedingly sorry that very pressing business makes it quite impossible for me to be at the conference to read my paper on 'Smoke Abatement.' I have asked Mr. Mason to take my place, as he will do most adequately; and I shall be glad if you will convey my full apologies to the audience."

Mr. Mason then summarized the paper, after remarking that it was a very difficult thing, in any circumstances, to boil-down an important and logical contribution of the nature of this paper without ruining the argument. When the reader did not happen to have written the paper, the task became even more delicate. He would try to select the writer's main statements of fact—leaving most of his wise comments, summaries, and the obvious conclusions at which the author arrived, for the careful after-consideration of those interested.

Discussion.

The Chairman said they had had an excellent paper from Mr. Goodenough. Smoke abatement was essential to-day from considerations of health. He did not think the general public fully realized what a lot of health-giving rays they lost when smoke and fog were shutting-out the sunlight from the towns and cities, and all that this meant to the health of the children especially.

Black Flag of Piracy.

If dust could be claimed to be the "aeroplane of the microbe," smoke and fog from coal fires might be described as the "black flag of piracy" in the towns. The public did not fully understand what the gas industry did in the direction of supplying smokeless fuel. The period of largest gas consumption now was on a Sunday, between 10.30 and 1.30; and practically the whole of this demand represented gas for cooking purposes. It was a very fair estimate to say that from 90 to 95 p.ct. of the town-dwellers to-day cooked by gas. With domestic help so troublesome to secure, the labour-saving advantages of gas fires in the home were becoming more widely appreciated. From personal experience, he could state that gas fires were being adopted at a tremendous rate; and if they did not altogether oust the coal fire, they would certainly do so in the case of casual living rooms. The future of smoke abatement rested with the carbonizing industries and the electrical industry.

Thirty Years Ago and Now.

Dr. H. A. Des Vœux (Coal Smoke Abatement Society) said his principal object in rising was to thank Mr. Goodenough from the bottom of his heart for the paper he had given them. Every word of it was telling, and every word was important. He believed that those who desired to spread the gospel of pure air would find sufficient in the paper to convince even people who were opposed to anything being done in the matter. He (the speaker) was an "old hand." He had helped to start the rousing of public opinion against smoke over thirty years ago. It had been a difficult task; but he thought they could congratulate themselves that, had this meeting been held thirty years ago in the same place, they would have been in the midst of a fog—a nasty, dirty, choky "London particular." These fogs used to be particularly common in the month of November. They had heard that the annual sootfall in London had diminished by nearly one-half within the last thirteen years. He believed it had dropped a great deal more than one-half within the last thirty years. One point which he thought should be borne in mind was that the greater part of the fogs in London were caused by cooking. It was the lighting of the cooking ranges in the morning, between 6 and 8 o'clock, that made the fog; and once a fog had been formed, it was extremely difficult, under certain atmospheric conditions, to dissipate it. Large numbers of gas cookers had been installed; but many people retained the old kitchen range, and used it, not in the summer, but in the winter. The cook would not stay in the kitchen with the gas stove out, and preferred to have the old coal fire in the winter. The gas companies were very far-seeing and public-spirited bodies; and if they would turn their attention towards doing something to comfort the poor cook's heart on a cold day, she would become much more impressed with the advantages of cooking by gas. There was no doubt that cooks preferred cooking by gas; but at the same time they disliked a dull kitchen. He (the speaker) was the first person, so far as he knew, to introduce a gas cooker, *plus* a coke boiler; and he had had this complaint over and over again. He knew the complaint was made still; and he thought great way might be made in getting rid of smoke, if the gas companies would pay attention to this particular aspect of the question. He did not believe the fires in the sitting-rooms mattered so much. Every one in the future was going to have either gas or electricity in a room which was used only from time to time; but there was great opposition to gas fires in a room which was intended to be used all day. He had always said: "Keep your one fire in the sitting-room, and you will do very little damage." There were good coke fires; and he still believed that low-temperature

carbonization had "something in it." Quite recently there had been held what he thought was the most important meeting in connection with smoke abatement that had ever taken place. It was convened by the Coal Smoke Abatement Society, and was held in the Guildhall, under the Presidency of the Lord Mayor of London. There attended representatives of every important authority in London and the suburbs, and of several county councils. A Committee was nominated, and would meet in the very near future.

A House Without Coal.

Sir Arthur Duckham, K.C.B., recalled the old days when he lived at Blackheath, and used to go to the Observatory Hill at Greenwich on Sunday morning and see the cloud of smoke rising all over London. Recently when he re-visited the spot, this sight was missing; the atmosphere on a Sunday morning gave one the impression that a coal strike might be in operation. Undoubtedly, there had been a tremendous improvement during the last 20 to 25 years. He lived in a house which he had designed and built himself; and he had never had any coal in it. There was central heating, coke-heated hot water supply, gas cooking, and gas fires in all the bedrooms. Downstairs, when the weather was not severe, they burned wood; when it was cold, coke was utilized with great success. There was no trouble about the cook requiring a coal fire. As a matter of fact, the maids had a sitting-room with a fireplace in it; but he had never seen a fire in it. They would not take the trouble to light one; for the house was sufficiently warmed by the central heating. With a gas cooker and coke boiler, and a radiator or two on the hot water system which could be turned-off in summer, one could have a house without chill; and there would be little need for a fire of any description until the evening, when the people were settling-down. He would like to point out that with radiator heating one should endeavour, as he himself had done, to have an air duct near the radiator, so as to secure a continuous supply of warm air. Gas companies were waking-up to the fact that coke could be burned efficiently in grates; and it was the easiest form for general heating.

Cheap Gas the Desire of the Industry.

As for gas fires, he could not imagine anyone having a bedroom without one. Wonderful strides had been made in the use of gas for heating; and he hoped to see still greater strides in the future. Those who were not near the coalfields must pay a little more for gas than others; but around the coalfields there was no reason why gas should not be taken from the collieries and coke ovens. He knew of several contracts under which the gas undertaking was buying gas at 6½d. per 1000 c.ft.; and this gas, as soon as things settled-down at work, should be sold at a price which would make gas universally used for heating. The whole intention of the gas industry was to sell gas as cheaply as possible; they had no wish to "do the public down." As a matter of fact, the only way in which the industry could flourish was by selling cheap gas; and everyone was working to reduce the cost.

Reduction in Sulphur.

Dr. J. S. Owens (Superintendent of Observations on Atmospheric Pollution, Department of Scientific and Industrial Research) said all present would have heard that the evil effects of London fogs were attributable to a great extent to sulphur in the air. Some years ago it was customary for people to say: "You may do away with smoke, but you will still have sulphur; and as long as you have the sulphur, you will have the same unpleasant and injurious effects." He happened, however, to have in his possession some figures which contradicted this. Between 1915 and 1926, there had been such an increase in the use of gas that the amount of sulphur poured into the air in London alone had been reduced to about 7000 tons a year. Now, the question was whether the sulphur had been reduced to a greater extent than would correspond with the reduction in solid impurity. He had figures from 1915-16 to 1926-27 showing the amount of deposit from the air in London. The total had been reduced from 450 tons per square mile to something under 300 tons. The percentage of sulphur had been reduced from 17 to 13. This was a very important thing. There was a reduction of the total deposit, but a greater proportionate reduction in the sulphur. Take Glasgow. In the same period the sootfall per square mile fell from 422 tons to 286 tons. This was a very good performance; but the sulphates had fallen from 21 to 15 p.ct. So there again one saw the same phenomenon.

Efficiency.

In one part of the paper, Mr. Goodenough referred to "useful heat;" the figures given being based upon calculations of efficiency. He (the speaker) was always fighting against the term "efficiency." The efficiency was very often taken as radiant efficiency or radiation *plus* convection efficiency; but when one had the two of them, one had not got the whole thing. Fires served other purposes—drying the house and walls, and ventilating. These were taken as losses; but they were really not losses. Keeping this in mind, turn to the comparative efficiencies of gas and electricity shown in the paper. Here he would go further even than the author. Mr. Goodenough assumed 100 p.ct. efficiency for electrical apparatus, and only 60 p.ct. for the gas fire. He might very well have said 100 p.ct. there also, because he (Dr. Owens) had seen cases in which there actually was 100 p.ct. efficiency. If the fires were used in the right way, his own opinion was that the only loss was the sensible heat which left the house; and this might be practically none. Therefore Mr. Goodenough might have said the over-all efficiency of gas was 75 p.ct., because of its ventilating and other uses.

The Case for the Children.

Mr. W. J. Liberty said he also lived in a house into which coal did not enter. Thus labour was reduced to the minimum. In his house there was central heating; and he had ventilators behind the radiators. He quoted facts which showed the vast improvement that had taken place in the atmosphere of London since the introduction of the gas cooker and the gas fire, and the consequent gradual diminution in the burning of raw coal in the houses. For the past thirty years, he had been intimately associated with work in a slum district of London, in connection with the children; and in one small area he had known of no less than 176 children all suffering from diseases caused by the absence of fresh air and want of sunlight in their homes. The only way of doing these children good was to remove them from this smoky region to a place where the air was pure and the sun shone. If a man fouled the public water supply, he would be looked upon as a nuisance, and would be prosecuted and punished. Would it not be equally reasonable and just that those who fouled the air by burning raw coal should be similarly punished?

Attack the Enemy.

Alderman F. S. Phillips (Salford) expressed agreement with nearly every word in Mr. Goodenough's paper. To his mind, there never was a time when greater effort than now was called for from the gas undertakings of the country to push the services which gas could render, to the immense benefit of the public. It was of no use for them to be always drilling if they never attacked the enemy. What was to be the outcome of this meeting? They must go out and attack the enemy coal smoke. What were they doing in their own localities to carry out the purpose of this meeting? In his own district, it was only within the last year or two that they had started the movement. They approached the doctors, and found that they were very human. Many of them believed in gas, though at first some would not listen. They had learned, however, that by attacking the situation directly, progress could be made. They should ask the "B.C.G.A." to help them, by urging on the work and suggesting to gas engineers throughout the country that they should take active steps, and if they were already taking active steps that they should adopt still more active means. It would not do to say that the contest between gas and electricity was over, and that they need not take much notice of electricity. It was only a short time ago that in his own town, with a quarter of a million of inhabitants, councillors got up and said that gas was done for, and that this was the day of electricity. This was a real difficulty. They had to get to the minds of the people. What about the future of the country, when its coal resources were at an end? It was a pressing question. If they must use up these resources, for goodness sake let them do so reasonably. All wasteful methods of using coal—not only because of the damage they caused, but because of the unnecessary depletion of resources that could not be replaced—ought to be met and dealt with. He hoped the result of this meeting would be that there would be more activity, and that the "B.C.G.A." would help them to get to closer grips with the subject. This would undoubtedly be to the great benefit of the country and of everybody in it.

Representing the Inventor.

Mr. A. C. Ionides, Jun., remarked that, though probably wholly unknown to those present, he ventured to represent a class whose voice was seldom or never heard. He was an inventor, and he had, for the last twenty years, been engaged in fuel economy. He succeeded in demonstrating, twelve years ago, that very substantial economies could be afforded by substituting gas for coal in industrial heating, owing to the facility it afforded (1) of effecting complete combustion and (2) of placing the heat where one wanted it. And even when the therm in gas cost six times what it cost in raw coal, enormous economies had been effected. Now there was in the body of the hall an inventor who had discovered a method of burning the smoke caused by an open grate where raw coal was used. Having drawn their attention to this, he considered he had done his duty.

Miners and the Use of Coal.

Mr. D. H. Price (Monmouthshire) said most miners got their coal delivered at perhaps 10s. per ton. If this cheap coal could be done away with, they would in many cases use gas.

The Worst Carbonizing Process.

The Chairman said they all knew that coal used in a grate was the worst carbonizing process. There was great waste, which they must try to stop. When coal was used under boilers or in houses, the products fouled the air and the nation was the poorer by their loss. The great carbonizing industries secured these products; and if the nation was to stand, carbonizing must be carried out properly.

Mr. Mason Replies.

Mr. Mason said there were really no points that required answering. Had Mr. Goodenough been present, he would, of course, have added considerably to the value of the discussion. Dr. Des Vœux had raised a point about servants. In his (Mr. Mason's) house, the maid's room had a small gas fire that quite solved the problem so far as she was concerned. He would like to draw special attention to the reference in the paper to the wonderful progress made by gaseous fuel in industry, and the remarkable illustration afforded by the Birmingham Corporation Gas Department, who were now supplying practically one-third of their enormous total output for industrial purposes. The outstanding fact was that even the wonderful figures obtained during the war, when every sort of industry was working at high pressure, had been passed in 1926, when the consumption of gas in Birmingham for industrial purposes was 2644 million c.ft. This was an astonishing figure, and one that must be encouraging to pioneers like Dr. Des Vœux, who, having been engaged on the problem for many years, might be inclined to ask themselves: "What is the good of it all?" He believed that in another few years, as Mr. Goodenough had said, it would be regarded as a positive crime against the community to contaminate the air and blot-out the sunshine. Such a meeting as this would help to build up a sane public opinion on a very vital subject; and therefore they could assure themselves of some good being done. He would convey to Mr. Goodenough news of the good reception accorded his paper.

On the proposition of the Chairman, a hearty vote of thanks was passed to Mr. Goodenough for his paper; and a similar vote to the Chairman for presiding was accorded, on the motion of Mr. H. C. Smith.

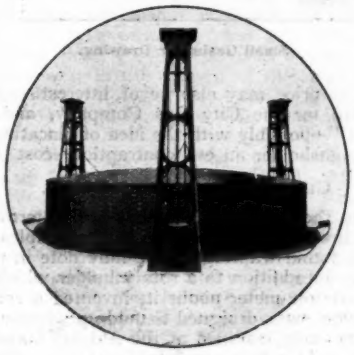
THE ROMANCE OF THE GASHOLDER.

By R. B. HODGSON, M.I.Mech.E.

[An Address to the Society of British Gas Industries, Nov. 17.]

To choose a subject for an address for such an occasion as this is not easy—especially realizing that our Society is not essentially a technical or scientific one. In the past we have had from the chair an interesting and instructive variety of subjects dealt with—subjects as varied as "The Story of the Channel Tunnel" and "The Metric System." We have had communications on high finance and industrial problems; and last year we had a very informative address dealing with an important side of one of our industries. As a member of what we term the Heavy Section of our Society (that is how we distinguish the manufacturer of a gasholder from the manufacturer of a gas burner), it has been to me a difficult matter to find a subject other than a non-technical one that would be of interest in some degree to most of the members present.

We are a Society whose members embrace many and varied branches of engineering, manufacture, and commerce. To enumerate a few: We sell coal; we make highly technical plant to convert the coal into gas and chemicals; we make pipes, large and small, through which the gas flows; we construct furnaces, stoves, fires, lights, and every conceivable piece of apparatus for the helpful and comfortable use of the gas consumer. And when it comes to preparing an address for this august and very representative assembly, one is perplexed as to where to begin.



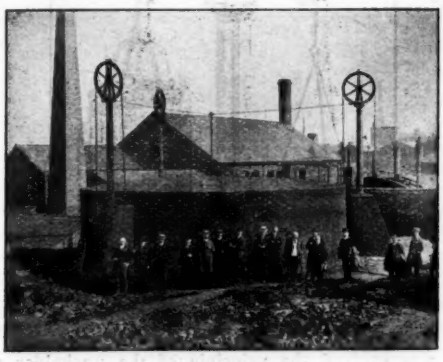
Early Balanced Holder.

Having been for the past twenty years associated with the construction of gasholders, and being naturally much interested in this essential item of gas plant, I have decided, without dealing with the matter technically, to sketch briefly the story of the evolution of this apparatus, and to call my talk "The Romance of the Gasholder." Romance is a word of wide and very varied application; and were I speaking on the subject of gas, oil, electricity, steam, ships, or motor cars, what an extraordinary story I would tell of the wonderful achievements of each! But gasholders! Someone may say they are as impassive and lugubrious as the pyramids—well, perhaps so. Turner, the great colour artist, found romance in a railway train, and I have seen etchings of a shipbuilding yard where every line was a poem.

Nevertheless, to most laymen, the suggestion of romance as applied to what he calls "Gasometers" would probably seem ludicrous; and, indeed, at first sight there appears little enough of the romantic to associate with such a subject. But he who traces the history of gas storage through its progressive stages will find it a sufficiently fascinating story—so much so, that within the limits of a paper one can do little more than indicate in outline the possibilities of the subject.

REMARKABLE STRIDES.

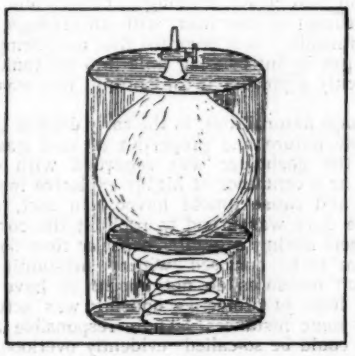
All along the line for the last hundred years the gasholder has spelled romance—the romance of progress and achievements such as the early pioneers of gas never dreamed of. It is, perhaps, the most encouraging sign of the progressive tendencies of our times that we continue to speak of romance in connection with our daily interests. We have been living in an age of progress unparalleled in history; and so rapidly do we grow accustomed to the new conditions brought about by the endless succession of discoveries and inventions, that we are prone to forget how few years have passed since gasholders were exceedingly small, unreliable, and very rare, while to-day they are almost unlimited in size, perfectly reliable, and occupy a place in almost every civilized town and city in the world. If we think back to the early stages of the gasholder—say, the gasholder that was constructed by Murdoch—and in comparison visualize (if you have not seen) the 15 million c.ft. capacity gasholder in New York, or the latest spiral or waterless gasholders now being erected, even the least informed of us must admit the remarkable strides made in gas storage.



Murdoch's Holder.

DR. CLAYTON'S USE OF BLADDERS.

Particularly interesting are the available records of the earliest attempts to provide suitable means for storing gases. These take us back to the early part of the eighteenth century—years before the discovery of coal gas as an illuminant. Here we find Dr. Clayton, in the early eighteenth century, for the storage of gas using bladders. He says, talking about the gas he had discovered as a spirit: "I then filled a good many bladders with the spirit, and might have filled more. I kept this spirit in the bladders a considerable time, and endeavoured several ways to condense it, but in vain; and when I had a mind to divert strangers or friends, I have frequently taken one of the bladders and pricked a hole therein with a pin and compressing gently the bladder near the flame of a candle till it took fire, it would continue flaming until all the spirit was compressed out of the bladder."



Lavoisier's Bladder Holder.

We find that round about 1780 there was described in some French works on chemistry a cylindrical vessel, inside which was a bladder resting upon a disc, which in turn was attached to, and activated by, a spiral spring. The mouth of the bladder was connected to a tap. When gas was admitted into the bladder, the disc and spring were depressed, and the bladder filled; while the gas could be expelled as required by the simple opening of the tap and the consequent action of the spring and disc.

FIRST WATER-SEALED GASHOLDER.

The name of Priestley is also mentioned in relation to the early construction of apparatus for storing gas; his invention being known as a pneumatic trough, which employed jars and sliding trays similar to those used in chemical laboratories—the gas entering the jars through a pipe. There was evidently much useful collaboration and interchange of ideas between Dr. Priestley and his celebrated French colleague Lavoisier. The latter, in 1782, illustrated and described a square gasholder (as we should now call it) working in a square tank filled with water, and provided with inlet and outlet pipes; the holder being suspended by a chain which passed over the curved end of the balance lever and was counterbalanced by ordinary weights in a scale. A few years later Lavoisier published details of a similar apparatus; his accompanying drawing showing an arrangement substantially the same as that described

by him in 1782, except that the holder and tank were cylindrical instead of square (see illustration).

Lavoisier's Balanced Holder.

Thus was evolved the principle of the gasholder using a water seal. Primitive as was its application in those far-off days, this principle has been universally adopted and applied to those giant gasholders which present-day requirements of the gas industry have rendered necessary. This little gasholder, it should be realized, was intended for use with oxygen gas, and was employed for fusing substances by means of the oxygen blow-pipe.

Another Frenchman, M. Meusnier, about the same time published details of a contrivance very similar to that of M. Lavoisier. In fact, as these two pioneers were closely associated with each other, it seems likely that the first water-sealed gasholder owed its inception to their joint efforts.

It is probable that the erroneous term "gasometer"—erroneous as applied to modern gasholders—had its origin about this period; for Lavoisier stated that he had "given the name of gasometer to an instrument of which he was the inventor, and had made with the object of producing a uniform and continuous supply of oxygen for experiments of fusion."

With the practical application and corresponding extension of gas lighting, gas holders became a very essential adjunct. They were constructed in rectangular form, thus following Lavoisier's original ideas, and apparently had an average capacity of about 500 c.ft. each. Internally they were supported by iron and wood framing. The water tanks were usually constructed of cast iron, with an arrangement of condensing pipes inside. It is recorded that an attempt was made to purify the gas by introducing lime into the tank; but as the lime was quickly deposited at the bottom, this was worse than useless.

It was perhaps natural that, in the early days of gas lighting and before the nature and properties of coal gas were fully understood, the gasholder was regarded with considerable apprehension as a container of highly explosive material which might burst and cause untold havoc. In fact, the Government of those days was urged to prohibit the construction of any such vessels having a greater capacity than 6000 c.ft., and to cause them to be enclosed within substantial buildings. Although such measures do not appear to have been made obligatory, a form of protective housing was actually carried into effect in some instances. Those responsible for this precaution—if it could be so-called—evidently overloooked the fact that, by so confining the explosive mixture, the danger would be increased rather than lessened in the event of an explosion.

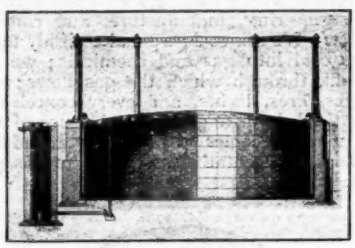
"The Opposition" had their case against the gasholder somewhat strengthened, perhaps, by the explosion in 1819 of a rectangular gasholder about 19 ft. square by 27 ft. deep at Manchester. From the official record of the occurrence, however, it would seem that one of the works' employees—having imbibed not wisely but too well—used a naked light in looking for a leak, a method still occasionally practised by householders with results more or less dire to themselves! In the instance to which I have referred, no serious damage resulted; and it is recorded that the supply of gas to the town was not affected.

Nothing could seriously impede the march of progress in the gas industry; and gasholders had obviously come to stay. Early in the nineteenth century, the foundations of the gasholder—a landmark to be known shortly the world over—had been laid; and it only required careful study and scientific investigation to evolve a container that would fulfil all the demands, big and little, that would be necessary to make it both useful and safe.

The Circular Holder.

Gas consumption was already increasing apace when the circular holder made its appearance; and it became necessary to construct these of greater capacity than the rectangular holders which had preceded them. Although cast-iron tanks had been generally used for those earlier rectangular holders, it is a curious fact—explained possibly by insufficient experience or the question of first cost—that many of the first circular gasholders had wooden tanks; and in at least one recorded instance a brewer's wooden vat was purchased by one of the early London Gas Companies and employed as a gasholder tank. Naturally, the durability and efficiency of these wooden tanks were very limited; but although brick tanks were introduced in 1818, a wooden gasholder tank was in use at the Brick Lane Works many years later.

It may be interesting, at this point, to refer to a report made in 1822 by Sir William Congreve, the Government Inspector of Gas-Works, in which he gave particulars of various gas-works then existing in and about London. In almost every case the sizes of the holders ranged from 10,000 to 15,000 c.ft.; but the report specially referred to one works as having "several of these erected in one place, of the *enormous size* of 40,000 c.ft. each gasometer." In the following year, his report contained a statement that "at the Whitechapel Works two large canvas bags, of about 15,000 feet each, were for some time used as gasometers, and that a smith's forge was placed near them." He went on to hint at the unpleasant consequences which might ensue from the ignition of this (as he termed it) "artificial volcano."



Small Gasholder Drawing.

Some idea of price may also be of interest. A gasholder erected in 1816 for the City Gas Company, and named the "Good Intent"—possibly with the idea of placating those who considered the gasholder an evil contraption—cost £737 4s. 9d.

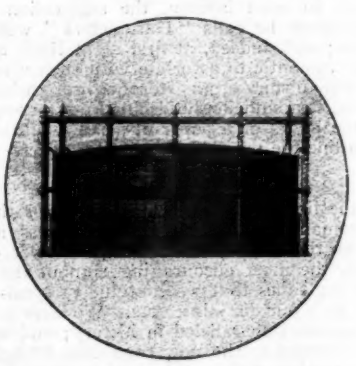
Clegg's Collapsible Holder.

Naturally, in the early days of what I may term "gas storage proper," inventions embodying new principles were tried, but apparently found wanting. One may note in passing that Samuel Clegg, in addition to a rotary holder which had something of the station meter about it, invented a sort of collapsible holder which was designed to fold-up when empty. One of these was actually installed at the Aldgate Gas-Works; but the collapsible holder had some fairly obvious disadvantages, and does not seem to have been adopted to any extent.

Mention of Samuel Clegg recalls that he is reputed to have foretold the possibility of gasholders "equal in diameter to the dome of St. Paul's Cathedral." It is doubtful whether, at the time that remark was made (it was rather in the nature of a challenge to a sceptic) Clegg really believed that his prophecy would come to pass. He could scarcely have seen how greatly his expectation would be exceeded; for the dome of St. Paul's, you may know, is but 102 ft. in diameter—a mere nothing in the construction of present-day gasholders, some of which are over 300 ft.

Telescopic Holders.

With the rapidly increasing popularity of gas, and the demand for greater storage facilities, gasholders constructed of several lifts telescoped one within the other supplied an admirable solution of the difficulty, and marked a notable advance on the engineering side. Although the telescopic holder was invented some years before it was brought into practical operation, its great advantages in giving maximum capacity with minimum ground space, and proportionate economy in first cost as compared with the duplication of single-lift holders to

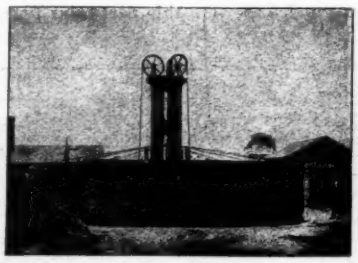


Early Telescopic Holder.

give an equal total capacity, have caused world-wide adoption of this type; and many thousands have been built and erected the world over on this principle. The dimensions of gasholders since Clegg's time have followed a succession of extraordinary increases; for whereas, about the middle of the last century, 250,000 c.ft. was considered a large gasholder, to-day we are building them up to 15 millions, and the future I believe will see them still larger.

PROGRESS IN SIZE.

In order to show the progress made in construction it may be pointed out that gasholders, on the first establishment of gas lighting, were square; and so followed the first idea of Lavoisier. Cylindrical holders were made about 1820; and one writer at the time wrote: "A gasometer is now being built

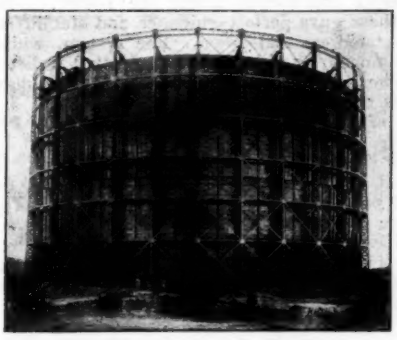


Boston Holder.

at Chester of the enormous size of 35 ft. diameter." From this date until about 1850, holders gradually increased in size to 60 ft. diameter; and for several years the size remained about stationary. This type was supported and guided with cast-iron columns and girders, and enclosed in masonry or cast-iron tanks; and they were in use at most of the large gas-works at the time. About 1847 a holder was built in the City of London of 100 ft. diameter; and from that date they rapidly increased in capacity.

Between this and 1870, gasholder construction went apace, and all sizes up to 2 millions were adopted. Mr. (afterwards Sir) Corbet Woodall erected in 1874 one of 3 millions, to be followed shortly by one of 5 millions at Old Kent Road, followed again by Mr. Hunt building at Birmingham two of 6 millions. These sizes have been eclipsed many times during later years—at East Greenwich one was erected of 12 millions, one at Bradford Road, Manchester, of 10 millions, and one at Sydney of 12½ millions, besides many others of large size at Beckton, Edinburgh, Sheffield, &c. In New York there are two of 15 millions.

All of these are column guided and erected in masonry, brick, or concrete tanks. In the United States (other than the two 15 million ones referred to) it is general practice to build in steel



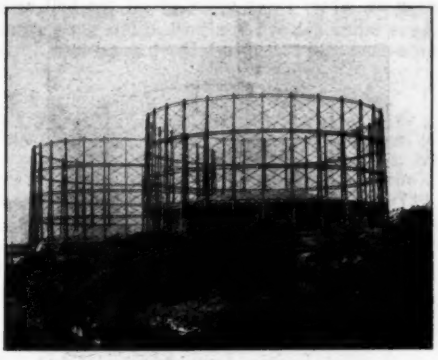
Ten-Million Holder, Manchester.

tanks. Several holders there I have seen, up to 10 millions, are all in steel tanks, and about 250 ft. diameter.

MECHANICAL FEATURES.

The gasholder represents a feature common to all manufacturing enterprises—it is a receptacle for the storage of the product. But in their design, gasholders are not resembled by any structure or equipment employed in any other line of industry. As the majority of engineers, other than gas engineers, are not familiar with the mechanical features of a gasholder, may I briefly say there are three principal parts (so far as the column-guided and spiral type are concerned)—the tank, the gasholder proper, and the guide frame. The tank, resting upon the ground, is filled with water to within about 15 in. of the top. The gasholder proper consists of the telescopic sections, of which there may be one, two, three, four, five, or six, as in the case of the largest holders that have been built. These sections consist of cylindrical steel shells, concentric with each other and the tank. When the holder contains no gas, these shells are nested together, resting upon the bottom of the tank, and submerged almost completely in the water which the tank contains.

The action of the gasholder is a very simple one, although I have found the man in the street very seldom understands its real object; nor does he understand its operation. Up to a few years ago, on the introduction of the waterless holder, as



Glasgow.

already mentioned, all gasholders were contained in either masonry, brick, cast-iron, or steel tanks filled with water. The tank in which the holder is immersed being filled with water, it is then ready for use. There is a space between the surface of the water and the roof of the holder. The gas enters by an inlet pipe into this space, and the force it acquires in being expelled from the gas plant, pressing on the surface of the water and underneath the roof, and over the whole area of both, causes the holder to rise automatically. Thus, by its own force or pressure, the gas provides room for itself; and in proportion to the quantity of gas entering, so does the holder rise out of the water. For instance, a holder having 100 sq. ft. area or about 11 ft. 4 in. diameter in rising 10 ft. will receive 1000 c.ft. of gas; and in descending the same quantity will be expelled. The water in the tank serves three purposes. It offers resistance to the gas for lifting the holder; it prevents the gas escaping or intermixing with the atmosphere; and it is the means of expelling the gas when the holder descends.

TYPES IN USE.

Gasholders to-day are generally of four kinds: Column guided; spiral guided; waterless; spherical high pressure. Each kind is made in widely varying capacity. The number of holders and their capacity are usually arranged to meet the demands of each respective gas-works, and are as necessary to the smooth running of a works as the boiler is to a steam engine or the pit-head gear to a colliery. To quote a recently published book—"The Engineers' Compendium": "Gasholders serve a variety of purposes. Nominally their principal function is storage, and their primary purpose is to bring the level hourly production of gas into line with the fluctuations in rate of consumption during the day. That is to say, while the consumption is lower than the make, gas goes to storage, while when the demand is greater than the make the gasholder supplies the deficiency. It is laid down that the storage capacity of a works should be 24 hours' maximum make. Where water gas is available, the amount of storage can be reduced to the neighbourhood of 18 hours, owing to the undoubted flexibility of make that the water gas plant gives."

It is not the intention of this paper to describe in detail the various types of holders in use, but generally to indicate their outline and usefulness. Up to the early part of the present century, the column-guided holder was used the world over, with one or two exceptions; and in many countries, such as Northern Europe, they were enclosed in brick houses, some of considerable size and costing vast sums to erect.

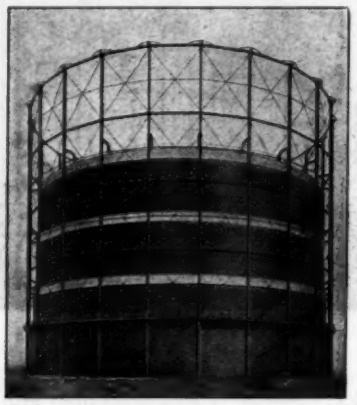
COLUMN-GUIDED HOLDERS.

The column-guided holder has been often described by writers and designers well known in the trade; and it is my intention only to sketch its leading features. Up the sides of the tank in all cases guides are fixed vertically, on which the holder slides up or down as the case may be. In the tank are placed two stand-pipes, one receiving the gas from the outside, and the other sending out the gas as and when it is required; the flow of gas in and out being regulated by the closing or opening of valves.

In a line with the tank guides referred to there is placed round the holder a series of columns (the number and size regulated by the size of the holder), tied together with girders and bracing so as to make the structure rigid and safe to resist all the strains that may come upon it due to the rise and fall of the holder. This structure in all cases requires to be very carefully designed, so as not only to resist the weight of the machine, but also to withstand any excessive wind pressure, and the constant wear and tear of an ever-moving body. Hence, when we see all the columns round a holder, they speak to us of

strength to resist failure, and to give guidance and smooth action to the moving parts of the bell, or bells, as the body of the holder is called.

This is constructed of material as light as possible, so as to make it float easily immediately the pressure of the gas enters and effects a pressure on the crown. On the top of each lift opposite the columns described are fixed rollers; and these rollers serve as wheel races upon which the bell ascends and



Six-Million Holder, Montreal.

descends. In passing, one should say that the roof of the inner bell of the smaller sizes is trussed on the inside, like an umbrella frame, to give it the necessary strength to support its own weight when at rest; but the untrussed system is applied with great success in the construction of very large holders, such as the 10 million c.ft. one at Manchester. When untrussed, on the holder coming to rest, it is supported over its whole area on a structure built-up inside the tank, taking exactly the same shape as the crown.

A good deal more might be said as to the detail working of a gasholder—such as strengths of material, the action of the cups and dips, the anti-freezing apparatus, pressures, the reasons for single lift *versus* telescopic, &c.; but, as stated previously, one can only summarize in a paper of this kind.

The column-guided holder for size held the ground in all countries up to a few years ago, when its formidable rivals the spiral and waterless types took the field. A recently built spiral holder at Belfast is of 7 million c.ft. capacity; and there have already been built six waterless holders of between 10 and 15 millions. Surely some progress since the days of Murdoch!

SPIRAL TYPE.

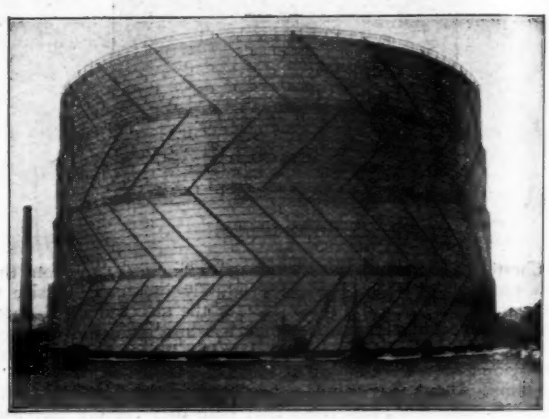
The spiral or columnless gasholder was evolved about 1888, and was the invention of Messrs. Gadd & Mason, the first one of its kind being built by Messrs. Clayton, Son, & Co., of Leeds, in 1889. This type of holder differs from that previously described, in that all columns, girders, and top rollers are dispensed with, thus leaving the holder free from any external

The First Spiral Holder.

appliance to guide and support it. Instead of the vertical columns and guides, its operation is effected by spiral guide-rails fitted to the sides of the holder at an angle of 45°. These guides, engaging with rollers of the twin or double twin type fixed to the top curb of the tank, guide with simple movement the vessel as it ascends or descends with a spiral action. The stresses are principally taken by the upper curb of the tank; and it is essential that when designing this type of holder the greatest care and attention should be given to the curbs and the number and strength of the spiral guides and rollers. In the early days, and for many years, engineers were wary of adopting this type of holder for other than small sizes, as they were sceptical of its stability; but during the last fifteen years many holders of large sizes have been built, and the example at Belfast has convinced us there is really no limit to the size that may be constructed—always given the necessary technical knowledge in designing, and courage on the part of the gas engineer to adopt the system.

While the efficiency in every direction of the spiral holder has been proved to be as perfect as that of the older column-guided type, it is of interest to state that, per unit of capacity, there is a saving of approximately 12 to 15 p.ct. in the cost; this being brought about by a considerable reduction in weight of material employed.

For 40 years the spiral holder gradually won favour, until it has become the popular type in this country for sizes up to 3 to 4 million c.ft. capacity. On the Continent of Europe very few have been erected, and apart from two or three in South America, Japan, and Australia, this particular type has not be-



Seven-Million Spiral, Belfast.

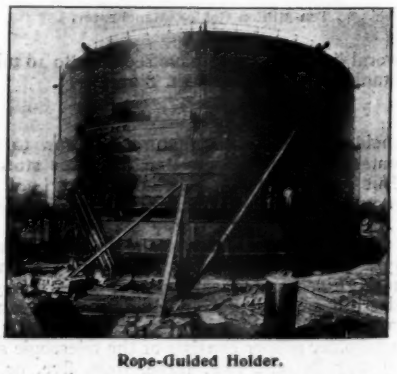
come popular abroad. Some years ago two or three were erected in Canada, but the experiment has not been repeated.

On the Continent, in Japan, and Canada, it may be that engineers did not care to take risks, due to climatic conditions; but these risks, with the present-day anti-freezing arrangements, may be counted as negligible.

CABLE-GUIDED HOLDERS.

About the same time as was invented the spiral holder, Mr. Lloyd Pease designed and put on the market the cable-guided holder, which at the time was most attractive. The principle upon which this was worked was by a series of ropes and box pulleys spaced equidistant round the holder. Ingeniously arranged, these gave perfect guidance and stability to the lifts as they operated up and down. The system, while perfectly sound mechanically, had its attraction in that it dispensed with the expensive columns and carriages of the column-guided holder, thus reducing the cost some 25 p.ct.

In considering the design of gasholders, Mr. Pease found generally, from their appearance, that the height to which a holder rises impresses itself more than its width. The width in almost all cases is greater than the height, and naturally is not of bad proportions to meet wind pressure. The internal gas pressure is considerably in excess of the external air pressure, and local or general distortion is prevented by this fact. The holder is in itself strong enough, constructed as it is of circular members connected by verticals, and the whole braced by a web of sheets in tension. Consideration of the structural



Rope-Guided Holder.

rigidity of an inflated holder led the inventor to the conception that if the base could be kept horizontal, nothing more was needed. That this was sound has been shown by the life

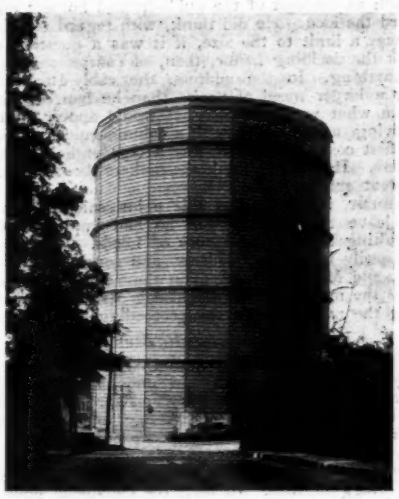
history of many holders in various parts of the world, for which the cable guides were adopted.

A striking example of this is the Middlesbrough gasholder, which was built thirty years ago in a steel tank 185 ft. diameter, which, immediately after the water was put in, became seriously out of level owing to marshy foundations. Had there been columns to this holder, the case would have been disastrous. As it was, the position of this expensive holder was saved by the fact that the holder was cable guided.

While the cable-guided holder had many features in its favour, it is probable that the chief reason why it ceased to be made was the competition of the spiral-guided holder, which evidently in its design offered an alternative more closely resembling accepted practice.

The Waterless System.

At the commencement of the paper, I said: "He who traces the history of gas storage through its progressive stages will find it a sufficiently fascinating story." So it has proved. In connection with the waterless gasholder, in a new catalogue just published by Messrs. R. & J. Dempster, they say: "Ours is a progressive age, and what is new to-day may be old-fashioned to-morrow. Nevertheless, time has up to now brought little change in the general principle of gasholder construction; but it would seem that the hand of progress has at last touched even the gasholder, for the advent and undoubted success of the waterless type bids fair to upset all previously established principles of gasholder construction."



Waterless Gasholder.

This new design, scarcely ten years old, is indeed novel, and has modified all previously established principles of gasholder construction in that it dispenses with the water tank, thus at once cheapening construction and at the same time eliminating the necessity for heating apparatus to keep the cups and dips from freezing. Whether this system will eventually rival the "Spiral" as the spiral did the "Column," time alone will show; but as a new thing one must admit its progress—otherwise in six years it could not have been recorded that 291,500,000 c.ft. capacity had either been built or was building. Of this capacity, no less than 17 holders range from 5 to 10 millions each.

A great deal from an engineering point of view could be written about this type; for it certainly contains many points in its construction and use that are both novel and interesting. I venture to suggest that the ingenuity displayed in the design and construction of this new system deserves the critical examination and consideration of every gas engineer.

The chief advantages claimed for it are: (*a*) No water tank. (*b*) Constant gas pressure. (*c*) Dry gas. (*d*) Cheaper foundations. (*e*) Easy enlargement at any time without stoppage.

Briefly described, the waterless holder has the appearance of a very simple structure. It consists of a shell with a disc or piston inside which travels up and down. The shell represents a polygonal cylinder built-up of fabricated plates of a specially pressed section, which of themselves form horizontal girders bound together by vertical stays of a novel design to keep the vessel rigid and plumb. The whole is covered by a self-supporting roof perfectly weather-tight; and for a gasholder a novel feature is that around the top windows are fitted to give ample light to the interior air space above the piston. The piston is fitted with a system of rollers for guiding it as it moves up and down. On the outer edge of this piston is a trough forming a tar seal for the gas. This seal is the real crux of the holder; and the piston, together with this seal, needs the most careful designing and construction, otherwise the whole efficiency and safe working of the holder would be endangered.

Technically the design is a most ingenious one, and worthy of close study and consideration; for it is only by an examination of detailed drawings, or an opportunity of seeing the actual structure in operation, that one can make comparisons between the old and the new. The waterless holder has come to stay. In America alone during the last four years 29 have been ordered, many of large size; and in England five are under construction, all of which have been ordered during the last twelve months.

Spheres.

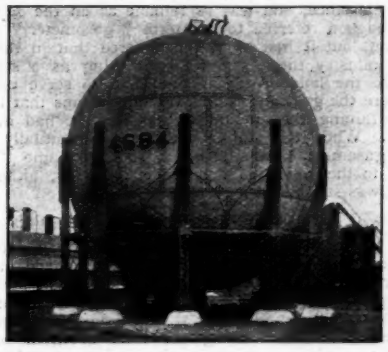
From the novelty of the waterless type, we pass to a further and later novelty—the spherical high-pressure holder. This, as far as I know, has only been adopted in America, where the distribution of high-pressure gas is much more in use than in this country. The advantages claimed for this type are:

(*a*) It can be used in any situation where gas may be stored or transmitted under pressure.

(*b*) It is cheaper in first cost—there being no tank and very small foundations.

(*c*) In outlying districts which grow rapidly the gas mains often become inadequate to supply the district. In such cases it may be possible to operate that section under pressure, and thus increase the capacity of the mains.

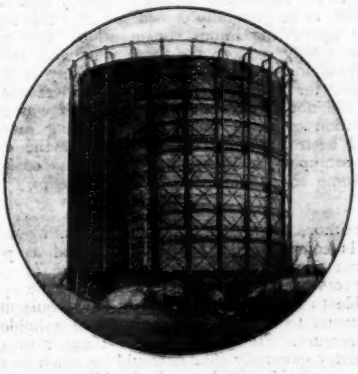
Another way in which the sphere may be employed is in end storage. Where a district is isolated, as at the end of a long gas main, it will receive a certain amount of gas per day. The greater part of this gas will be consumed in a comparatively short peak-load period. Without a sphere a compressor



Spherical Holder.

supplying this long main must be able to pump a sufficient quantity to take care of the maximum hourly demand. With a sphere riding on the line the compressor need be able to pump per hour only one-twenty-fourth of the daily consumption—the sphere acting as a reservoir. During hours of low consumption the excess gas is pumped into the sphere, until the demand exceeds the capacity of the compressor, whereupon the deficiency is supplied from the storage.

The sphere, like the waterless holder, has no tank, cups, grips, lifts, or carriages, nor has it any rollers or moving parts. Its cost for any given capacity is theoretically independent of the maximum pressure for which it is designed. This cost is little different for 50 lbs. pressure against 10 lbs. I do not know what the limits of the sphere will prove to be; but I believe that in any system employing pressure the sphere is a most economical means of storage.



Ten-Million Tank and Holder, New York.

In conclusion, I may say that in the preparation of this paper I have found a good deal of pleasure and interest, and in many ways have been assisted and helped by friends in the gasholder world who have supplied me with literature and photographs.

Particularly to the following would I express my grateful thanks: Mr. Geo. Horton, of Chicago; Messrs. R. & J. Dempster, Ltd.; Messrs. Clayton, Son, & Co., Ltd.; Messrs. W. & T. Avery, Ltd.; Messrs. Ashmore, Benson, Pease, & Co.; Mr. E. Lloyd Pease; and Messrs. Bartlett, Hayward, & Co.; also for extracts obtained from "King's Treatise on Coal Gas."

Discussion.

Mr. R. J. MILBOURNE, being called upon by the President to open the discussion, said he wished in the first place to thank Mr. Hodgson for his address, which must have necessitated the expenditure of an immense amount of time looking-up old records, not only by himself, but by those firms to whom he had paid a tribute of thanks in the concluding paragraph. He (the speaker) was one of those who never thought there was any advantage in assuming that the gasholder had any connection with a bladder. The bladder was used in chemical laboratories long before gas was even thought of; and he always considered that the Murdoch holder, which was erected in about 1792, was the progenitor of the present holder. As gas engineers, he did not think they need go beyond that date.

RELIABILITY OF THE GASHOLDER.

Quite early in the address, Mr. Hodgson remarked that holders up to a few years ago had been unreliable; and on this point he begged to differ. When one considered that the Murdoch holder was erected some time around 1792, and that it had worked continuously until within ten years ago, there was no justification for saying that gasholders were unreliable. Further than this, he thought that, if they visited any of the older gas-works, it would be found that the only part of the original plant which was still in existence was the gasholder. His own experience was that when the holders had had to be cut-out, it was not because they were unreliable in any way, but because they had served their purpose, and the gas consumption had grown to such an extent that it was necessary to increase the storage. In the case of one gas-works with which he was connected, a holder that was erected in the 'fifties was still in existence, and was as reliable as on the day it was put up. Mr. Hodgson referred to the term "gasometer" as being an erroneous one; but it had to be remembered that in the early days of the gas industry there was no such thing as a station meter, and therefore the holder at that time had to serve two purposes. It had to store the gas, and it was the only means that the manager had of ascertaining the amount of gas that he had made or was sending out. When the station meter was eventually introduced, the term "gasometer" was dropped, and the name "gasholder" was applied to the holder as they knew it to-day, although on the Continent it was still called a gasometer.

ADVANCES IN DESIGN.

In going through his review, Mr. Hodgson had overlooked the fact that there had been considerable advances made in the design of gasholders which were worthy of mention in an address of this sort. The great gas engineer Sir George Livesey introduced the reduced guide-framing; and it was at that time that the gas engineering profession were considering the total abolition of gasholder guide-framing. This transition in the design of holders was the means of focussing attention on that particular problem; and it was due to the discussion which took place at the time that Mr. Gadd invented the spiral holder. It was stated in the address that about the middle of last century a 250,000 c.ft. holder was considered a very large one; but it would be found on reference to Clegg's book that in 1857 the Imperial Gas-Works, Hackney Road, constructed a holder having an outer lift 200 ft. in diameter and 38 ft. deep. This tended to show that the gasholder had developed in size much more rapidly than one might be led to suppose from the address. Further on he noticed—but this might be a printer's error—the statement: "From this date until about 1850, holders gradually increased in size to 60 ft. diameter." Then four lines later: "About 1847 a holder was built in the City of London of 100 ft. diameter." In another part of the address it was stated that the water in the tank served three purposes; and he felt he must take exception to the assertion that it was "the means of expelling the gas when the holder descends." He did not think the water expelled the gas. It had always been his view that it was the pressure of the floating holder which performed this function.

NECESSARY STORAGE CAPACITY.

With regard to the amount of storage capacity that was necessary, it used, as stated, to be generally considered that this should be equal to twenty-four hours' maximum consumption. But this ratio had now been substantially reduced, as those who were interested in the gasholder business knew only too well, for many of the gas undertakings had not for the past twenty years increased their holder capacity. He did not think, however, that this was altogether due to the introduction of water gas. It was owing more to the fact that there had been a gradual equalization of the day and night loads, consequent upon the increased use of gas cookers and fires, which had become so popular during recent years.

HEAVIER HOLDERS.

Again, the author, when referring to the column-guided gasholder, said: "This is constructed of as light material as possible, so as to make it float easily immediately the pressure of the gas enters and affects a pressure on the crown." This he (the speaker) hardly found it possible to reconcile with present-day requirements, because it was not unusual to have to add weights to a holder in order to increase the pressure. He would like to suggest to gas engineers and to the industry generally that it would be much to the advantage of the life of a gasholder if, instead of adding these separate cast-iron weights, the thickness of the sheeting and the vertical stays and guide-framing was increased—so increasing the cost of the holder and creating more work for the makers. [Laughter.] Once more, the roof of the inner lift was trussed now, not only in the case of small holders, but for large holders also. At the present time he was himself constructing a spiral holder which would be nearly equal to the Belfast holder in capacity; and this was being fitted with a specially designed trussed crown, in order to increase the weight and consequently the pressure thrown. While referring to the Belfast holder, he would like to point out that there appeared to be a little error in regard to its capacity. If the dimensions were worked-out, it would seem that it was only a 6 million c.ft. holder, and not a 7 million c.ft. one.

THE SPIRAL TYPE.

Alluding to the spiral holder, the author said: "This type of holder differs from that previously described in that all columns, girders, and top rollers are dispensed with, thus leaving the holder free from any external appliance to guide and support it." This seemed to him to be a mis-statement of the facts, because, although the guide-framing was removed, there were substituted for it the spiral guides and rollers which did exactly the same work as the ordinary guide-framing. Mr. Hodgson said that the stresses were principally taken by the upper curb of the tank. It was his own view, however, that the upper curb of the tank had no more to take than the thrust on the side plates. Later on it was remarked that the holder at Belfast "has convinced us there is really no limit to the size that may be constructed." He trusted that this was not intended to include him (Mr. Milbourne). When designing a very large guide-framed holder, he went very closely into an alternative design for a spiral-guided holder. He found his difficulty was so to design the structure that the hydraulic cups could be kept in a perfectly true condition. In studying the matter, he came across an invention by a Swiss gas engineer, strange to say—one of the smallest gas-making countries in the world—by which a system of horizontal girders was arranged in connection with the bottom of the cup. This proved to be a very effective method, and by it he secured all the strength and rigidity he wanted. But on going into the cost of the increased material one had to put in, he found that the outlay would come to quite as much as the cost of the guide-framed holder; and therefore he abandoned the idea. He did think, with regard to spiral holders, that there was a limit to the size, if it was a question of cost. If cost was not the deciding factor, then, of course, as engineers they could do anything. In the address, the cable-guided holder had come in for a larger meed of praise than he had ever known it to enjoy. From what was said there, it would appear that there was an actual saving, as compared with a column-guided holder, of some 25 p.ct. in first cost; and yet it was a type of holder that had not made progress. He did not think the makers themselves had pushed it to any great extent.

The PRESIDENT, interposing at this point, said he was very sorry to have to leave the meeting, but he had important Government business awaiting him in the House of Lords. He had listened to an extraordinarily interesting address, and congratulated Mr. Hodgson upon it, and Mr. Milbourne upon the additional information he had given to the meeting. He would ask Mr. Hodgson to take the chair during the remainder of the proceedings.

WATERLESS HOLDERS.

Mr. MILBOURNE (continuing his remarks) said he now came to the waterless type of holder, which had undoubtedly excited a great amount of interest both in this country and abroad. It was, perhaps, true to say that this was a progressive age, and that what was new to-day might be old-fashioned to-morrow; but he would like to remind them that there was an old adage which ran: "There is nothing new under the sun." The tankless holder was originally invented by Clegg in 1818. In fact, the collapsing holder to which reference had been made was really a tankless holder. A little later Nicholson and Coles brought out a very ingenious method of using a movable diaphragm. Then in 1849 Knapton invented a waterless gasholder, in which the lower half of the side sheets was to be formed of leather or other suitable material, and, as the bell descended, the bottom, slightly less in diameter than the crown, disappeared—the crown of the holder resting on the ground when it was empty. Some of these old inventions might even be revived again. It was impossible to predict what future developments might come about. There might be some high-pressure holder like the "Hortonsphere" which would come into vogue, or there might be some improvement in gas manufacture which would enable gas to be made at such a rapid rate that only a small relief holder would be required for the largest gas-works. The interest aroused during the last few years in waterless holders might continue; and he felt sure that the development of this type of holder was far from having reached its maximum. Before long other types would no doubt be placed upon the market.

IMMENSITY OF THE GASHOLDER.

Prof. ARTHUR SMITHELLS, C.M.G., F.R.S., D.Sc., said he also had to leave to fulfil another engagement; but Mr. Griffith at the beginning of the meeting had asked him if he would propose a vote of thanks to Mr. Hodgson. This vote, he was sure they would all agree, was thoroughly well merited. Speaking personally, and he was confident that the same remark applied to the whole of the audience, he had greatly enjoyed the address. He (the speaker) had no expert knowledge of gasholders, and little (if any) expert knowledge of romance; but, at any rate, he had been an eager and interested listener to what had been put before them. It had been a fascinating story. Now, it happened that the subject was of peculiar interest to him, for the reason that a gasholder always impressed him enormously. It gave him an idea of immensity which was really very impressive. It made him feel proud of his fellow creatures who could do such tremendous things as erect these great structures. Not long ago, he had had occasion to learn something about gasholders, because he had, in an unguarded moment, undertaken the duty of speaking to the public on the subject of the gas industry. He went through agonies which he could hardly describe in his attempt to discharge this duty of broadcasting to the miscellaneous millions, in the space of fifteen minutes, an account of the gas industry. It was a thing that only the foolish would ever undertake. He was warned that he must not on any account advertise the industry, and that he must make himself intelligible and in-

teresting to the general public. On the other hand, when he consulted the gas industry, he was told that he must be sure to speak of this, that, and the other thing, and that he must not say this, that, or the other. He went from one person to another, and among them was Dr. E. W. Smith, who put his money on the gasholder. He told him to speak of the immensity of the gasholder and its functions. Dr. Smith told him all sorts of interesting things, some of which surprised him immensely. He said that one could put the whole population of Birmingham into one of their big gasholders. [Laughter.]

The Disaster in America.

One thing about Mr. Hodgson's address was its rather melancholy timeliness in relation to the disaster that had occurred in America. It was a terrible thing to have happened. One did not want to lay blame without knowing that it could be justly laid; but it did seem shocking that such a thing should occur at the present time. They must all be anxious about the public alarm which an incident of this kind was bound to create; and he would urge the necessity for taking immediate measures, in quarters where they might have any influence, to see that the journalist, who was really helpless on such occasions, was informed of the exceptional character of the accident, and of the improbability of anything like it happening in this country. It was deplorable that on occasions of this sort the public was left in such ignorance and apprehension. If the general Press had a knowledge of science, they seemed unable to use it in the least degree in connection with the news they purveyed. Mr. Hodgson had, he thought, omitted one point which would appeal to the public. This was that the gasholder was a great guarantee of continuity of service. Think of the gas industry's score there against the rival industry. Compare the gas industry and its ample storage with the electrical industry, where in a moment one was plunged in darkness, and there had to remain until the defect was remedied. The question of corrosion which occurred in gasholder tanks raised all sorts of interesting problems. In conclusion, he would again express his own thanks, and those of the members generally, to Mr. Hodgson for his address.

The Object of the Address.

Mr. HODGSON said he had put before the meeting what he had termed "The Romance of the Gasholder;" and with all due respect to his friend Mr. Milbourne, who was a specialist and a scientist, he (the speaker) had not come there to discuss technical matters in connection with the building of gasholders. At the same time, he did welcome any discussion that might be the means of imparting more knowledge of the construction of such an important piece of plant as the gasholder. Some people seemed to have the idea that anybody could build a gasholder; but this was not so. Everything had to be scientifically planned-out before starting on the actual work. He would suggest that Mr. Milbourne, in his address next year, should give them an account of the construction and design of gasholders from the earliest days up to the latest 15 million c.ft. waterless holder.

Corrosion of Metals.

Mr. SAMUEL CUTLER, in seconding the vote of thanks, remarked that it was no easy matter to compress within the compass of half-an-hour an address on the developments of gasholders over a period of a hundred years. He congratulated Mr. Hodgson upon the scope and lucidity of his address. As a matter of historical interest, he thought some reference should have been made to the design of the old cast-iron columns and tanks, which were replaced by the use of steel. He (Mr. Cutler) might mention, as a fact which was not generally known, that his firm built over 49 years ago at the Ipswich Gas-Works (which had recently been before the public in another connection) a wrought-iron tank 122 ft. in diameter. He believed this was the first wrought-iron tank to be erected in this country; and it was still in use and in perfect condition. He mentioned this because it served as an example of the lasting qualities of iron as compared with steel, in reference to which they had heard so much in recent months about corrosion. He understood that the Society of British Gas Industries were interesting themselves in the formation of a Research Committee; and he hoped the first subject to which the Committee would devote their attention would be the corrosion of metals in connection with holders and other constructional apparatus in use on gas-works. There had come before them in recent months examples which showed the most alarming depreciation which was going on in gas-works. Whether this was due to corrosive action of the gas passing into the holders or to climatic conditions was a matter that ought to be elucidated. No doubt, as stated in the address, the waterless holder had come to stay; but, as Mr. Hodgson had very truly remarked, the piston seal was the crux of the system, and this must be positive and dependable, if all element of doubt was to be removed. There was one other remark he would like to make, and that was in connection with repairs to gasholders. He thought there was at present an inclination on the part of people to be much too venturesome in the use of heat and flame methods. This made the public nervous, as witness the Press notices in the latter part of last year in regard to the accident to the Folkestone holder, and the recent references to the Pittsburg calamity. But there were also other holders to which accidents had occurred. There was the case of Manchester, for example; and there had been rumours of an accident in Canada. They should not surround these occurrences with mystery, as had been done in the past, but should make the fullest possible investigation into the causes, so that anything which was wrong might be remedied.

Credit where Credit is Due.

Mr. A. H. LYMN remarked that they all believed in giving credit where credit was due; but he thought the speakers so far had omitted to say that the latest development in gasholder construction—the waterless system—was the invention of the Germans. Though the Germans were their former enemies, they should at least give them credit for this.

Good Old Wrought Iron.

Mr. T. R. BARKER (Messrs. Thomas Piggott & Co.) thought the use of the flying lift, which was a useful method of adding to the storage capacity of existing holders, was worthy of being placed on record, even if it was not very popular to-day. On the point of reliability, he would like to call attention to one particular holder that the firm with which he had the honour to be connected had erected at Bristol in 1866. This was entirely of wrought iron, with the exception of the columns, which were of cast iron; and it was only within the last few years that they had been called in to examine, report upon, and make certain tentative repairs to, it. And curiously enough these repairs were to the externally exposed parts which had corroded, whereas little had required to be done after all these years to the floating vessels, which, as he had mentioned, were constructed of good old wrought iron.

Researches upon Corrosion.

Major RICHARD MILES (Messrs. Newton Chambers & Co.) referred to recent researches upon the relative corrosion of the three most popular materials used in the manufacture of gasholders—wrought iron, "Armco" iron, and mild steel. Dr. Newton Friend immersed several samples of each of these materials in sea water for some years, and found that the relative loss in weight was as follows: Wrought iron, 100; mild steel, 126; and "Armco" iron, 152. In other words, the "Armco" had corroded more than the wrought iron and mild steel.

An "Armco" Iron Holder.

Mr. W. BESWICK (Messrs. Ashmore, Benson, Pease, & Co.) said he would like to voice the interest which they had all felt in the address, and their gratitude to Mr. Hodgson for having reviewed the history of the gasholder. They could only frame their present policy in the light of past experience; and to go back to history certainly helped them to move on safe lines to-day. He might say, so far as his Company were concerned, that they were at the present time building one very large gasholder in "Armco" iron. The matter was being very carefully considered in the constructional aspect, so as to secure the utmost safety and freedom from corrosion. Construction had a great deal to do with the possibility of formation of corrosive liquids or allowing electrolytic action to take place within the gasholder; and whatever might be the relative effects upon "Armco" iron and wrought iron under the conditions described by Major Miles, it did not necessarily follow that the same results would occur inside a holder. One had to suit the holder itself to the nature of the gases it had to store and the conditions under which it had to work. He felt himself that the Research Committee to whom reference had been made should do great service to the industry. They knew that in America the Mellon Institute had established a very important and effective research service, which was working for the interests of the whole industry. That Institute was also endowed with a very large amount of money. It was the monetary question which so often made it difficult for a voluntary organization like their own to carry on a similar class of work. Still, the firms themselves were continually undertaking research. He thought all those associated with the Society were earnestly facing the task of making their work as durable as that carried out in past years, to which reference had been made by previous speakers.

Gasholder Accidents.

Mr. J. W. SCOTT (Messrs. R. & J. Dempster) said he had been rather pleased to hear the allusion by Prof. Smithells to the recent gasholder at Pittsburg; and he would like them, as a Society, to express their sympathy with the sufferers from the disaster that had occurred. ["Hear, hear."] He had had an opportunity of visiting the scene of the holder accident at Manchester a short time previously; and he noted the suggestion of Mr. Cutler that full investigation would be a very good thing in connection with such occurrences. Well, he had no opinion to express publicly with regard to the accident at Manchester, except to say that, so far as the material was concerned, which he had tested and analyzed, there did not seem to be much to blame in that, considering that it had had a service of something like 46 years. Mr. Milbourne had suggested that the wire-rope or cable-guided gasholder did not last very long or give much service. In this, he entirely disagreed with that gentleman. Personally, at the time the cable-guided holder was introduced he was opposed to it, because he was more interested in the spiral type; but it served a good purpose in helping to prove to the public that it was possible to build gasholders without external framing. Mr. Milbourne had also mentioned the term "gasometer." It was difficult to understand why the general Press persisted in calling a gasholder a gasometer, though so far as this country's Technical Press was concerned he did not think the term had been employed for forty or fifty years. The only case within his knowledge of a newspaper using the word "gasholder" occurred in a recent article—the "Evening Standard." He had been interested in the references to the waterless holder, and to the wonderful progress that had been made with it in so short a time. No doubt the present waterless holder was only a pioneer, and other types would come along as competitors to the waterless holder; and they were all the better for competition. As to the idea that there should be a complete investigation into gasholder accidents, it would be recalled that some time ago there was an accident to a holder on the Continent; and the matter was tackled by those concerned in a very thorough way. Two full inquiries were held; and every effort was made to ascertain the cause. It was certainly desirable that some such course should be followed in this country.

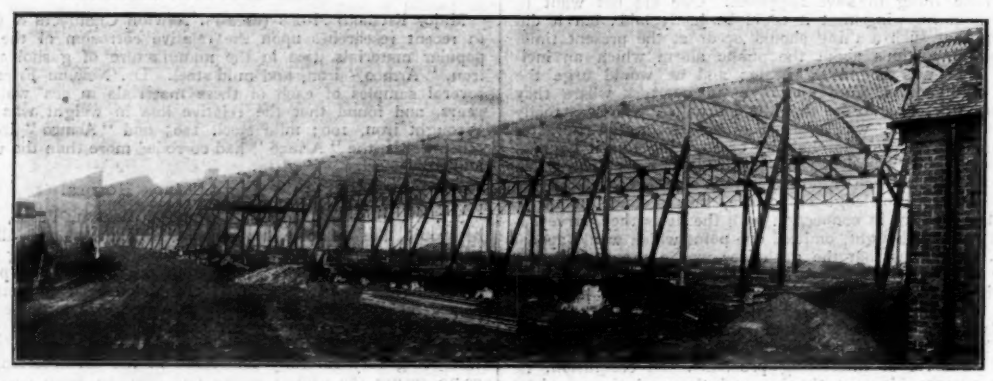
Rapid Holder Capacity Increase.

It seemed strange that one should associate romance with such a subject as a gasholder; but one little thing he could tell them seemed appropriate to the title. A little while ago, he heard that a waterless holder on the Continent was about to be increased in capacity while in operation. It was a 750,000 c.ft. holder; and he thought it would be very interesting to go and have a look at the way in which the work was done. On making inquiries, however, he was told that the whole job had been completed. The enlargement was to 1,500,000 c.ft.; and the work was started on Sept. 19 and finished on Nov. 5—or a period of seven weeks. So far as experience in this country

went, that certainly was bringing romance into the construction of gasholders. He understood that the accident in Pittsburg had occurred to a holder in a water-sealed tank; but one could hardly surmise how a 5 million c.ft. vessel could behave in the way described by the popular Press. Again he congratulated Mr. Hodgson upon the interesting story he had put before them on a particularly awkward subject.

Mr. HODGSON said he had been much gratified by the reception accorded his address, which it had been a great pleasure to him to bring before the Society. He had expected that there would be some criticism; but he did not start-out to prepare the address with the object of dealing in any way with the technical or scientific side of gasholder manufacture. His idea was merely to sketch the story; and for any transgressions technically, he claimed their indulgence.

MORE ACRES FOR THE HEAVY TRADE FAIR.



Rapid progress is being made with the immense extensions to the permanent buildings of the Heavy Section of the British Industries Fair in Birmingham.

It was first considered by the Birmingham Chamber of Commerce—the controlling body—that a new building in two spans 650 ft long, giving an additional area of 70,000 sq. ft., would be sufficient to meet the needs of the coming spring display of heavy goods.

It was seen later on, however, that this extensive enlargement would be altogether inadequate. The Birmingham Chamber of Commerce, therefore, had no alternative but to adopt the bold course of adding a third span, which, together with bringing-out the boundary towards the main L.M.S. Railway line, now gives a total enlargement for the year of 115,000 sq. ft.

The extra span, the footings for which have already been constructed, will be in exactly the same proportions as the first two spans, now nearing completion, as shown above.

THE MANCHESTER JUNIORS AT THE GRAPPENHALL WORKS.

For report of the visit of the Manchester and District Junior Gas Association to the Richmond Gas Stove and Meter Company's Works at Warrington, see last week's "JOURNAL," pp. 458-9.

National Illumination Committee of Great Britain.—The Committee have published a report of the Bellagio meeting of the International Commission on Illumination, which took place from Aug. 31 to Sept. 3 last, and an account of which was published in the "JOURNAL" for Sept. 21, p. 679.

North of England Gas Managers' Association.—The sixteenth half-yearly auxiliary meeting will be held at the offices of the distribution department of the Sunderland Gas Company, Hind Street, on Saturday, Dec. 3, at 2.30. The Chairman (Mr. C. F. Barrow, Distribution Superintendent to the Company) will deliver his address, and Mr. Chas. Dru-Drury will speak on the Education Scheme of the Institution of Gas Engineers. Following the business meeting, the Company's showrooms and workshops will be inspected.

Institute of Fuel.—We have received from the Institute of Fuel a pamphlet giving a list of the Council, members, and officers of the Institute, together with information as to the objects of the organization, an account of the immediate programme, and of projected developments which are proposed, as indicated in the Presidential Address of Sir Alfred Mond to the Institution of Fuel Technology on Dec. 7, 1926. As is well known, the Institute of Fuel is the result of the amalgamation of the Institution of Fuel Technology and the Institution of Fuel Economy Engineers. It is noticed that the Institute consists of 54 collective members, 472 ordinary members, and 3 student members. The subscription for the ordinary members is £2 2s., for collective membership £10 10s., and student members £1 1s.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Visit to Wakefield.

On Saturday, Nov. 19, the Yorkshire Junior Gas Association visited the works of the Wakefield Gaslight Company, where Mr. C. H. Chester, the newly-elected President of the Association, is Assistant Engineer and Manager.

On arrival at the works, the visitors were divided into groups for the tour of inspection. The guides were Mr. C. W. Ward (Engineer and General Manager to the Wakefield Gaslight Company), Mr. C. H. Chester, and Messrs. T. Day, D. Whitehead, R. A. Walker, and F. Lodge (ex-President of the West Riding of Yorkshire Gas Salesmen's Circle).

WAKEFIELD GASLIGHT COMPANY'S WORKS.

The Wakefield Gaslight Company was formed in the year 1822, and the works were built on the existing site. The original foundation stone is incorporated in the present retort house, which was built in 1900. This house was extended in 1908 to accommodate a bench of twelve settings of inclined retorts. In 1925 seven of the inclined settings were demolished; being replaced by six settings of horizontal retorts in 10's, arranged in five tiers.

The old coal conveyors were incorporated in the new scheme. Consequently during the period of reconstruction it was necessary to sling these from the roof, so that they might serve the hoppers used in connection with the remaining inclined settings.

The new work was divided into two contracts; one including settings, coal hoppers having 48 hours' capacity, charging and discharging floors, combined charging and discharging machine, and electricity generating plant in duplicate, arranged in the power house built by the Company. This contract was entrusted to Messrs. Drakes, Ltd., of Halifax.

The other contract included the retort house conveyor which delivers the coke towards the centre of the house into an inclined yard conveyor, both being of the De Brouwer type. These conveyors have one common driving gear operated inside the retort house; the motive power being steam. The two contracts were carried out in the appointed time of seven months, and the plant was put into commission without a hitch. The scheme of reconstruction provides for a further bench of six settings of 10's, to be set horizontally in the remaining portion of the retort house at some future date. The capacity of the new bench is 1½ million c.ft. of gas per day, and the remaining five old inclined settings have a capacity of 750,000 c.ft. per day.

In 1923 the obsolete pipe scrubbers were demolished; and upon the site the exhauster house was extended to accommodate a new Waller steam-driven exhauster capable of passing 125,000 c.ft. of gas per hour. The demolished pipe scrubbers were replaced by a brush washer built by Messrs. W. C. Holmes & Co., of Huddersfield, in 1924. This washer has a capacity of 3 million c.ft. per day.

In 1926 the condensing plant was enlarged by the installation of a water cooled condenser, built by Messrs. Drakes, of a nominal capacity of 3 million c.ft. per day. The water cooled condensers were placed upon the site of an obsolete Walker mechanical washer, which was removed for the purpose.

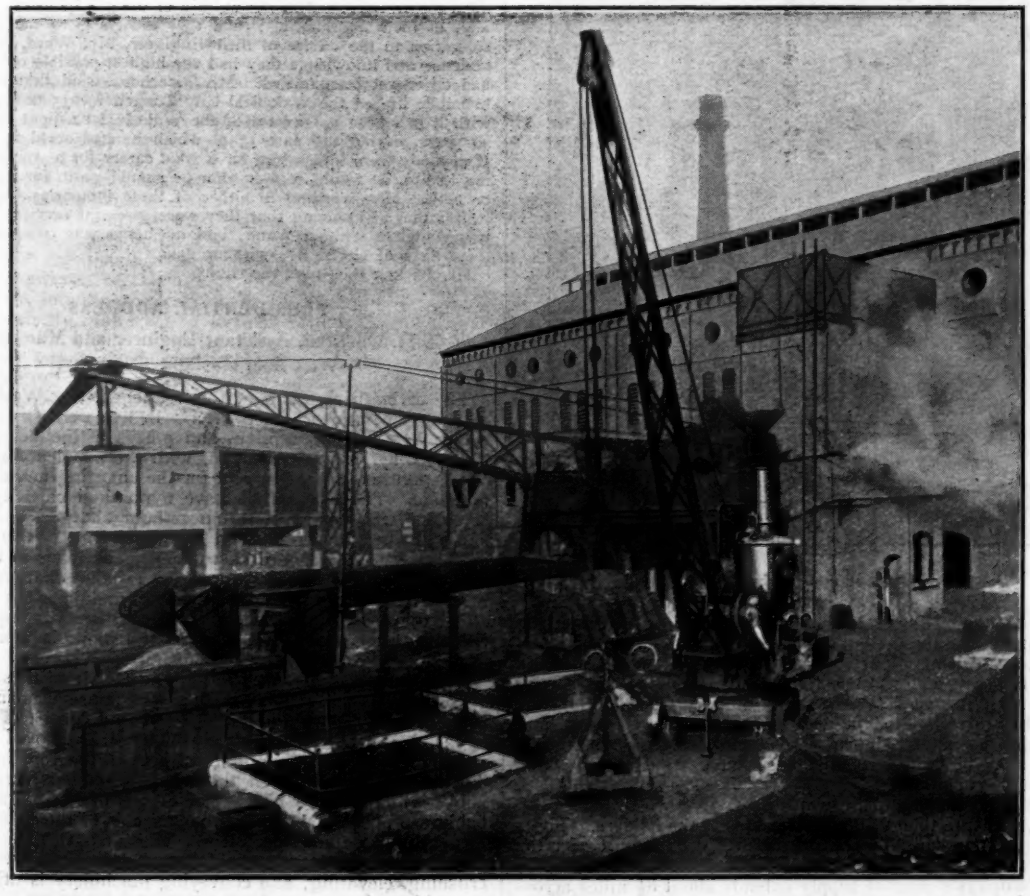
The gas after leaving the exhausters passes through a "P. & A." tar extractor, a Clapham "Eclipse" washer, then through a Holmes scrubber before reaching the purifiers. The Clapham washer has this year been dismantled, thoroughly overhauled, built-up, and put to work after giving twenty years' continuous service. The purifiers are arranged in the open air, and consist of four boxes, 36 ft. by 25 ft., followed by two catch boxes. Revivification is carried on *in situ*, and the purifying material is removed only once per annum.

Blue water gas is manufactured in two plants having twin generators, built by Messrs. Perry & Co., Ltd. The producers, however, have been re-designed and fitted with new grates, which have greatly increased the output and at the same time considerably reduced maintenance costs.

The declared value of the gas sold by the Company is 500 B.Th.U. gross, and the desired quality is attained by making comparatively rich gas in the horizontal retorts, and bringing it down to the required value by the addition of blue water gas. This method enables the management to provide a gas having a constant thermal value.

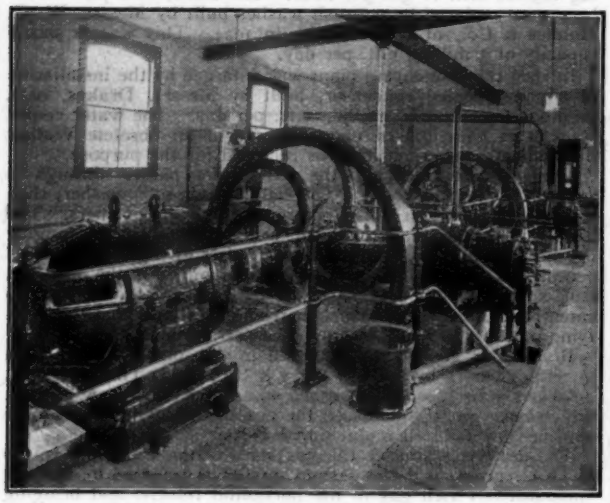
In 1923 one of the larger gasholders, the flying lift of which was then steel rope guided, was modernized by the removal of the rope gear and the fitting of guide rollers, together with the necessary guides. The holder was also generally overhauled and repaired; the work being done by Messrs. Clayton, Son, & Co., Ltd., of Leeds. In 1925 the small holder received attention; the crown being stiffened. Vertical stiffeners were introduced, together with cross bracing in the framework.

A coke breaking, screening, and washing plant deals with a large proportion of the coke output, providing coke suitable for domestic requirements and breeze for industrial purposes. This plant consists of an elevator, breaker, Zimmer screen, hopper, and washing channels, and was designed and built by Messrs.



COKE BREAKING, SCREENING, AND WASHING PLANT, TOGETHER WITH CRANE FOR HANDLING SLURRY.

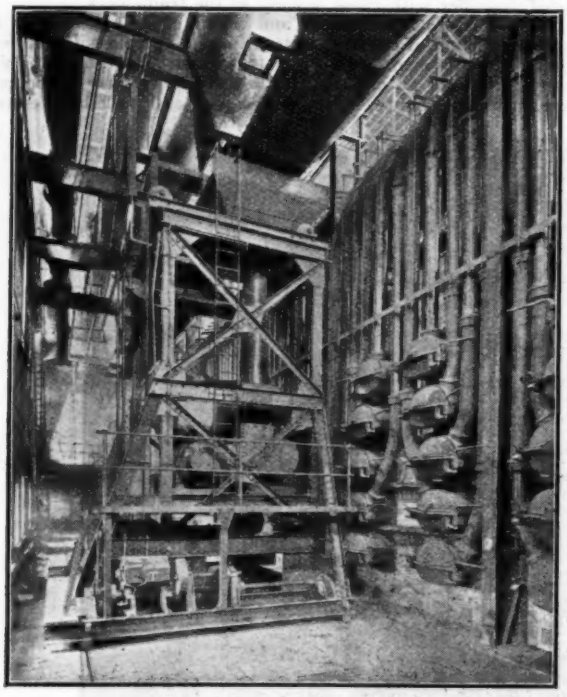
W. J. Jenkins & Co., Ltd., of Retford, in 1908. The output from this plant commands a ready sale. Surface water is used for the quenching of the coke, and this is collected in an old gasholder well. Adequate pumping gear elevates the water from the well into an overhead tank which provides a supply at an adequate pressure for quenching and washing purposes.



Electrical Generating Plant.

The water tank is placed upon an old tower, suitably extended, which originally carried the coke conveyor from the inclined retorts.

It has been found necessary to instal a crane and grab for removing slurry which finds its way into the storage well from the washing plant. The crane and grab will deal comfortably



Combined Charging and Discharging Machine.

with 30 tons per day. Consequently it is only necessary to operate it for one day at intervals of two months.

The steam-raising plant consists of three Lancashire boilers and one Babcock boiler. The Lancashire boilers are fitted with coke burning furnaces and Green economizers. The Babcock boiler takes the whole of the load during the heavy season, and is specially designed to burn coke dust and washer settlings. It is provided with mechanical stokers, superheaters, and labour-saving appliances.

Two station meters made by Messrs. J. & J. Braddock, of Oldham, measure the gas before it passes to the holders. Three district governors suitably control the pressures required for the parts of the city which they respectively serve.

The Company's area of supply extends about 8½ miles across the greater length and is about 3 miles across the greatest width; and the output of the gas for the year 1926 was 395 millions, compared with 352 millions in 1921 and 317 millions in 1916.

At tea, following the works tour, the chair was occupied by Mr. G. A. Moorhouse, J.P., Chairman of Directors of the Wakefield Gaslight Company, who was supported by Mr. Ward, Mr. R. B. Wilson (Secretary of the Company), Mr. Chester, and Mr. S. H. Packer (Senior Vice-President of the Association).

Mr. MOORHOUSE, in a brief welcome to the visitors, said the Wakefield Company felt it a great honour that there should be so large a response to the invitation issued to the members to see the works at which their new President was engaged. The gas industry undoubtedly had made tremendous strides in its century of history, and particularly in the later years, but he was convinced it had by no means come to the end of its usefulness and progress. When they remembered how great a part the gas industry played in the maintenance of material for munitions during the war, and how great a blessing it was to the service of the public during the long coal dispute of 9126, it was, they must agree, an industry of which every man engaged in it could justifiably be proud.

The PRESIDENT (Mr. Chester), in calling on Mr. Packer to move a vote of thanks to the Chairman and Directors of the Wakefield Gaslight Company, and to Mr. Ward, for their hospitality and kindness, said he wished first to express his own personal thanks for the ready manner in which his Directors and his Chief had placed the facilities of the works at the disposal of the Association.

Mr. WARD, endorsing the welcome extended to the visitors by the Chairman of Directors, said that when one considered that every town could have only one gas undertaking, it was obvious how necessary and valuable was such an Association in bringing together men of different undertakings, to enchange experiences and ideas, to the mutual benefit of the individuals concerned and of the industry which they served. Mr. Ward said he would take the opportunity of publicly congratulating Mr. Chester on his election to the presidency of the Association. If Mr. Chester did as well in his service to the Association as he did in that to the Wakefield Gas Company, they would have an excellent President.

Mr. PACKER, proposing the vote of thanks to the Directors of the Company and to Mr. Ward, said that one of America's greatest business leaders, John Wanamaker, had once declared that "every young man starting in business will have to go over a hard road, and find its turnings for himself; but he need not go over that road in the dark if he but take with him the light of other men's experience." This was the purpose of the Yorkshire Junior Gas Association, and it had been fulfilled by their visit to Wakefield.

Mr. F. J. JACKSON (Sheffield) seconded the motion.

Mr. MOORHOUSE, replying, said it was a source of pride to know that a body of men familiar with gas plant and its functions should find satisfaction in seeing the Wakefield Works. The members of the Board of Directors were not gas engineers themselves, but they were men keenly interested in the welfare of the gas industry, and, naturally, of their undertaking; and they always gave the utmost consideration to the advice of their Engineer, Mr. Ward, of whose experience and knowledge they had the highest possible opinion. They had never yet been misled. Mr. Moorhouse said that he had been in public life on the Wakefield City Council for 35 years, and along with it had been a Director of the Wakefield Gaslight Company for 28 years, during the past 13 of which he had acted as Chairman. If anybody were to ask him for a good career for a young man starting in life, he would suggest that he should go in for gas or water, or both. Men working in either of these industries had the great satisfaction of knowing that they were essential services. No house was complete without water, and no home was complete—even in these days of electricity—without gas.

Mr. PACKER then took the chair.

PRESIDENTIAL ADDRESS

of C. H. CHESTER, Assistant Engineer and Manager to the Wakefield Gaslight Company.

The carbonizing plant at the Wakefield Gas-Works consists of 6 beds of 10 horizontal retorts in five tiers, 20 ft. long by 24 in. by 18 in., ⏢ section, and 5 beds of inclines 20 ft. long by 20 in. by 16 in., ⏢ section, with the usual accessory plant. We generate our own current for the charging and discharging machine. The horizontals have a nominal capacity of about 1,500,000 c.ft. per 24 hours on 12-hour charges, and the 5 inclines about 750,000 c.ft. on 6-hour charges. The latter are only brought into commission during peak loads in the winter, and are generally now worked on 12-hour charges as being most efficient from the point of view of make per ton and labour costs, coupled with the fact that very little gas is required from them, as the more efficient horizontal plant is worked to its maximum capacity.

At the time of the Association's last visit to these works in 1925, the reconstruction of the retort house was in progress, prior to which our carbonizing plant had consisted of 12 beds of inclines in one bench, 7 of which were removed by stages. Gas manufacture was maintained from the remaining bench during the work. When the whole scheme is completed the house will contain 2 benches of 6 beds of horizontals, or probably a 6 and a 5, bringing the capacity of the house up from 2 to 2¾ or 3 millions per diem. The lay-out of the new plant is arranged to facilitate this extension. The original coal crushing, elevating, and conveying machinery is utilized, with everything else renewed.

The coke is removed by two " D.B." conveyors (retort house and incline conveyor); the gearing being arranged to allow the incline conveyor in the centre of the house to take coke from both benches on completion.

WATER GAS PLANTS.

In addition to the aforementioned plant, we have two blue water gas plants of the twin type, with a total capacity of approximately 1¼ millions per diem. We have entirely redesigned the brickwork lining and grates to give greater strength and efficiency and to reduce maintenance charges.

Briefly the process is to blow both generators in parallel (there being a common connection at the base), and to steam up in parallel or down either one and up the other. We work a 2-minute blow, 2 minutes up, 2 minutes down one and up the other, and finish with a 2-minute up run. We find this gives the best results on quantity and quality, giving in addition protection from explosion at each end of the run—a point it is necessary to guard against in this type of plant. A much lower CO_2 content is found in the gas from this as compared with other makes of plant, owing to the shallow hot fires and time contact with two fires; while the retort, which is superimposed upon the fire or generator, heats-up incoming fuel by waste gases and by the passage of hot gas through it.

Our practice is to make a good-quality gas in the coal gas plant under carefully regulated level-gauge conditions, and to dilute with from 10 to 15 p.ct. of water gas to the prescribed standard of 500 B.Th.U. gross.

The water gas enters the retort house foul main between the retort house governor and the exhauster; the water gas and the coal gas being at approximately the same temperature. This practice is undoubtedly the best way of mixing two gases of different composition and specific gravity, and helps considerably to avoid uneven quality of gas leaving the holders to the town.

There is a possibility that the hot water gas picks up some of the light hydrocarbons from the crude coal gas, which would otherwise be thrown down with the tar. Experience in this direction at the many works I visited in connection with the running of Tully gas plants showed conclusively that where the water gas was mixed at the inlet to the town gasholders in the cold state, or at various other points of the works plant, there was stratification, and that, on changing-over to mixing hot in varying quantities as the quality of the coal gas increased or decreased, no further trouble was experienced. Three years at Wakefield have proved this. It is not possible to use small valves—say, 3 in. downwards—for the regulation of the crude water gas, owing to frequent blockage; and a 6-in. or larger valve can successfully be employed if intelligently handled. It is essential to avoid back-pressure on the carbonizing plant by making connection where there is a " surplus " vacuum—*i.e.*, between the retort house governor and the exhauster. With this method we have obtained the best thermal yields per ton and have maintained a fairly even composition of gas—a very important factor. To assist also in the last-mentioned aim, the air for revivification of the purifiers is carefully regulated by meter.

Our object is to produce a gas of as nearly constant quality and composition as possible, to eliminate much of the trouble in the distribution department; and with the aid of recorders on both " make " and " town " gas, a large measure of success can be obtained on even small or medium-sized works where trained chemists are not available for shift work. Great care must, however, be taken to give the shift foreman instructions how to interpret alterations in quality and to work his plant accordingly, and also to keep recording instruments in order, especially when two shifts are employed and there is a " tailing off " towards the end of the dog watch.

By gradually improving the control, and because of our horizontal carbonization, we now obtain the following yields: Gas, 14,500 to 14,800 c.ft. per ton (500 B.Th.U.) = 72·5 to 74 therms per ton. Coke sold, 9·95 to 10·05 cwt. per ton of coal used. Tar, 11 gallons.

COKE.

Largely increased competition has been felt in the sale of this commodity during the past two years or so from coke oven coke and also cheap coal, owing to the depression in the coal and steel trades. The quality will have to be kept at a high level successfully to compete against the cheaper article. Gas coke is without doubt better fitted for the domestic field than its rival, but it is necessary to buy coal carefully, in order, first, that a suitable free-burning coke of the right texture may be produced. Secondly, so that it may suit varying requirements, it is necessary that it should be properly graded and as dry as possible. In the case of washed breeze, it is necessary to ensure that the washing is efficiently carried out. Even in a mining area such as ours we have developed a good demand for domestic coke by carefully grading and screening, coupled with bagging.

Our washing method is by flotation along long troughs, with catches inserted at intervals to collect the " sinkers," which are removed after each washing and burnt in our own steam boilers, to prevent the waste incidental to the thorough cleansing specially necessary for smithy work.

NAPHTHALENE AND PURIFICATION.

Horizontal retorts undoubtedly produce more naphthalene than inclines; and following this decomposition (naphthalene being a product of decomposition) a tar of a higher specific gravity is obtained. I will summarize briefly the advantages we obtained by reducing the temperature of the gas to about 52° or 54° Fahr. after it had passed through the air coolers fitted with holed discs which provided some light oil washing.

(1) We decreased the specific gravity of the bulk tar slightly, and had more for sale, owing to the added light oils.
(2) Our washing plant has been more efficient.
(3) Our purifiers are better to work in every way, and show reduced tar content in the oxide for sale.
(4) Less trouble with back-pressure in works plant.
(5) Less syphon water to collect, and fewer naphthalene deposits, owing to less moisture. What naphthalene there is still in the gas does not fall so readily, owing to the fact that gas does not drop further in temperature on the district than that to which it has already been cooled.

It has now become an accepted fact that the less moisture there is in the gas, the less naphthalene will deposit; and one cannot help feeling that, before the naphthalene bogey is finally eradicated, gas will have to be stripped of its moisture content by some plant or other. What trouble it may bring it its path has yet to be found by experience over a term of years, or by research. Several processes of drying and extraction are now being put on the market, and must receive earnest consideration in the near future. Work on condensation and purification problems has yet to be done; and this important part of our process is not to be accepted as having reached finality. We have to consider, for example, how to adopt it to various climatic and local conditions, different methods of carbonization, naphthalene, drying, and sulphur removal by our own product gas liquor, &c. We find that by washing with warm strong gas liquor in the Clapham washer, and finishing off in the Holmes washer, a considerable reduction in the sulphur compounds takes place—the appreciable reduction of about 4 grains (from 31 to 27) on purified gas.

Though our naphthalene troubles have been greatly alleviated, and are below normal, we are not yet free from them; and possibly oil washing will be adopted in the near future for treatment at certain periods of the year when the climate is against us. Work in connection with purifiers has shown that even they can cause a lot of trouble with naphthalene by giving up moisture at critical temperatures, to deposit later, with naphthalene, on the district.

It has been the happy custom at Wakefield to change purifiers once yearly only; and though this is still possible, it may prove worth while, in order to work at lower temperatures, to change twice yearly, in order to lower the moisture content. We have definite proof that an increase in the moisture content has increased our naphthalene complaints; and after taking steps to reduce the moisture, we reduced our complaints, though the naphthalene content was practically the same.

Until recently we made our naphthalene tests by the orthodox method; but having had our attention drawn to the new method by a well known engineering firm, we have definitely turned down the old method as being inaccurate, always giving results on the low side—in some cases as much as 50 p.ct. wrong. The new method is practically correct and, moreover, is simpler. The reason will be obvious to you. In the old method there are three stages of the test open to error, two of them to a large error—namely, the use of water for dissolving the naphthalene picrate, which is dissociated in the boiling process, even if the latter is carried out in vacuum. Thirdly, any small error in the titration of the filtrate is multiplied as much as ten times.

Though the naphthalene figures with the new test may be as much as double the figures of the old test, it is well to know the worst. I will give you briefly the new test. Bubble 10 c.ft. of gas in the usual way. It is not necessary to know the amount of acid or its strength, so long as it contains no picric in suspension and there is more than sufficient to extract the naphthalene. After bubbling, the whole liquid is carefully collected and filtered through a vacuum filter, using as small a filter paper as possible—say, 1 in. in diameter. Any washing of bottles, &c., and precipitate must be done with dilute picric acid—say, about N/40. After thorough evacuation, the paper and picrate are carefully washed with water into a beaker, and the contents are boiled until thorough dissociation has taken place and all the naphthalene is driven off, thus leaving only the picric, which is cooled and titrated with N/10 soda.

The calculation is then simplified out to

$$\frac{V \times 0{\cdot}197 \times 100}{G}$$

where V = c.c. of N/10 required to neutralize
G = gas passed corrected in the usual way.

CHEMICAL CONTROL.

In the retort house we check temperatures daily. B.Th.U. readings, and vacuum and pressure recordings, are checked hourly throughout the 24 hours. The work of the purifiers is checked six times in 24 hours, and the washing plant daily.

With a little skilled help in the daytime and on nightly visits, this is a duty which, with organization and good instruments, can well be undertaken by shift foremen.

Laboratory analysis of all our products proves worth while, and alterations give room for thinking out a reason—and reasons sometimes mean trouble. Coal testing on even a small plant, with care, can satisfy the needs of medium-sized undertakings. From these tests it is possible to value a coal for its quality, its gas yield in quantity or quality, and the characteristics of the coke produced.

We must try to cultivate a finer degree of accuracy in detail, if laboratory work is to be progressive. For instance, 50 p.ct. of a recent purchase of measuring cylinders, pipettes, &c., was found to be as much as 2 p.ct. wrong, and had to be discarded or corrected. Multiplication of errors must be strictly guarded against. I would like to emphasize the need for close co-operation between the laboratory and the works. For example, an increase in the sulphur content may indicate excessive "pull," leaky retorts, or inefficient washing or purification. The same remarks apply to naphthalene content.

Details in works engineering and management account largely for final efficiency and ease in working. With a little daily supervision and attention to trifles, costly breakdowns or excessive renewal charges can be avoided in many instances. To mention only a few items, there are leaky glands, with loss of steam and wear of piston rods and glands (the same applies to gas valves and washer driving shafting); engine knocks and new brasses; steam joints and steam pipe insulation; sparking of electric motors; oil creeping; &c. We have certainly found it worth while to insulate boilers and pipes. Daily, weekly, or monthly examination of all plants, according to work done, undoubtedly pays. I am firmly of the opinion that a clean, well-preserved works is a great incentive to the workman to be thorough and careful, and provides a healthier, brighter, and happier condition of work.

Unaccounted-for Gas.

In an area largely affected by mining subsidence, this is a problem demanding constant attention Drawn joints and completely fractured pipes, with leakage or flooding of mains in low-lying districts, are troubles requiring careful observation. Stoppages in such districts have been traced to this trouble. It is a debatable question whether steel mains overcome it, for we have found that, instead of breaking, steel pipes bend, forming syphons which in time fill up with condensate, which is difficult and expensive to clear. We keep a man continually testing for leakages, and we find the expenditure well repaid. Two other sources of unaccounted-for gas are perhaps worthy of mention—namely, faulty consumers' meters, and the correction for temperature and pressure. With regard to the former, we have a system of testing meters *in situ*, and find a large number register slow. We correct gas make to 60° Fahr. or 30 in. bar.; and this correction may account in extreme cases for 1·5 p.ct. of unaccounted-for gas.

Education Scheme.

During the past year the parent Institution, through its Advisory Committee, has thoroughly overhauled the Scheme originally drafted. The Junior Associations have been given opportunities of expressing their views and of submitting suggestions. Your representatives have attended meetings in Birmingham and two in London to discuss the Scheme; and while perhaps it does not yet fit in with our ideas, there is undoubtedly a great improvement in that special machinery has been put in motion in the shape of Local Advisory Committees, to help to smooth-out difficulties and to be a real aid to the student. I ask you to show your willingness to support the Scheme, and not to be afraid of approaching the Local Committee if you desire to join.

Mr. F. Firth (Leeds, Junior Vice-President of the Association) moved, and Mr. J. W. Wood (Department of Coal Gas and Fuel Industries, Leeds University) seconded, a vote of thanks to the President for his address, to which Mr. Chester replied.

The President announced that the next meeting of the Association would be on Dec. 17, at Brighouse, when Mr. W. E. Stephenson, of South Bank, would read a paper on "Incidentals in the Manufacture of 400 C.V. Gas."

Soil Corrosion Studies.—The United States Bureau of Standards have been for more than fifteen years engaged on a general study of corrosion and electrolysis damage to materials underground—such as gas main systems. This is now being extended to include a new study of the fundamental principles which cause soil corrosion—*i.e.*, corrosion independent of stray current damage. This work is being carried out under the direction of Dr. H. D. Holler, who has recently been appointed on the chemical staff of the Bureau. The fact is emphasized that it will be many months, if not years, before any important conclusions can be expected. However, it is remarked that any method of ascertaining beforehand the probable rate of corrosion in a specified soil of a particular kind of pipe would be of such great value as to warrant a very expensive and extended investigation for its establishment.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Auxiliary Producers for Waste-Heat Boilers.

Sir,—In connection with Mr. Rendle's paper on p. 451 of the "Journal" for Nov. 16, is it not a misnomer to say that the producer is an "auxiliary," seeing that the plant is designed of

(1) Boiler capacity	5500 lbs. evaporated.
(2) Producer capacity	4700 " "
(3) Waste-heat capacity from bench, by difference	800 lbs. evaporated?

It would rather appear that the better and more correct designation may be a variant from one of the winning papers in the recent Coke Competition—viz., the paper by "Eureka," "Journal" for Jan. 27, 1926, p. 213.

Nov. 19, 1927. Ad rem.

Dehydration of Tar.

Sir,—I note in your issue of Nov. 16 a letter under the above heading. My paper was submitted in the hope of making some small addition to technical knowledge, and not to raise controversy (either in these columns or a more appropriate place) on the respective merits of plant. I feel called upon to reply, however, and must take exception to the statement that the only novelty in my system of dehydration is in the use of steam. Reference to Patent Specification No. 196,399, and study of the possibilities of the plant show that:

1. The tar is heated near the surface, which minimizes frothing.
2. The distilling and condensing elements are in one vessel, whereby the heat from the vapours is used to heat the crude tar before it reaches the steam coils.
3. The steam used automatically adjusts itself to deal with wide variations in the water content or rate of feed of the crude tar. The tar leaving the dehydrator is at all times uniformly dehydrated and at fairly constant temperature. Overheating is impossible even when the feed ceases for long periods.
4. No labour is needed at the dehydrator, and the labour for the steam used is but a tithe of that needed for attention to direct fired plant.
5. Corrosion and wear are negligible, and no repairs have been necessary during five years' continuous work.
6. No coking can occur, and the plant runs for a year without stopping. Cleaning is then simply a matter of running-off the tar and raking-out the sludge.

As regards cost of steam, the efficiency of modern boiler plant is appreciably higher than that of any direct fired pot-still or Wilton coil. The heat is applied within the body of the tar; and with ordinarily efficient lagging the heat losses are so small as to be more than compensated by the higher efficiency at the boilers. Actual test has shown that cold tar with 7 p.ct. of water can be dehydrated with a consumption of fuel at the boilers of under 30 lbs. per ton of crude tar.

In all the features mentioned it must be conceded that my system shows advantage over direct fired plant; and this has been fully proved by five years' experience at Newcastle and other places.

As compared specifically with the Wilton system, steam dehydration applied to pot-still plant distilling 100 tons daily has, in fact, given superior results, not only in smoothness and safety, but in operating and repair costs. For example, steam for dehydrating represents about one-eighth the labour of one boilerman, against at least one man attending to Wilton coils; also, maintenance of the steam still is negligible compared with that of direct fired coils.

May I suggest that the fire risk in direct fired tar plant may not be dismissed so lightly?

S. A. Wikner.

Newcastle-on-Tyne,
Nov. 21, 1927.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

Kilmarnock Gas and Water Order Confirmation Bill: Returned from the Commons, agreed to.

Special Orders.

The Bristol, Chelmsford, Dewsbury, and Harrogate Gas Orders were laid before the House, and referred to the Special Orders Committee.

Manchester Gas Order.

The Special Orders Committee reported on Nov. 15 that they had examined the Manchester Gas Order, 1927, and the petition against the Order presented by the Urban District Councils of Stretford, Audenshaw, Droylsden and Cheadle, and Gatley. They were of opinion, after considering the points referred to, that there was no necessity for further inquiry by a Select Committee.

HOUSE OF COMMONS.

Progress of Bills.

Kilmarnock Gas and Water Order Confirmation Bill: Considered; read the third time, and passed without amendment.

Bristol, Chelmsford, Dewsbury, and Harrogate Gas Orders: Copies presented.

LEGAL INTELLIGENCE.

CHALK FUEL, POWER GAS, AND BYE-PRODUCTS CORPORATION.

Further Hearing of Summons for Alleged Fraud.

The hearing of the summons against those concerned with the activities of the Chalk Fuel, Power Gas, and Bye-Products Corporation, Ltd., was resumed at the Mansion House Police Court, London, on Thursday, Nov. 17, before Alderman Sir George Truscott. The defendants are Sir Charles B. Herne-Soame, Bart., Robert George Harley, and Lieut.-Col. Edmund Octavius Eaton. A fourth defendant (Mr. Edward Warden) has recently died.

It was alleged that they had conspired to obtain money by falsely pretending that certain reports appearing in the prospectuses and pamphlets issued by the Corporation, with regard to a fuel consisting largely of chalk, were true and genuine reports. It was stated by the prosecution that laudatory reports had been published by the Corporation with regard to the fuel, over the name of an engineer who had tested it and who had reported adversely upon it. (The proceedings at the previous hearing were reported in the "JOURNAL" for Nov. 9, p. 398.)

At the resumed hearing, some of the witnesses who had given evidence previously were re-called for cross-examination by Mr. J. P. Valetta (Counsel for the defence).

The first witness recalled was the Rev. H. H. Bartrum (of Lathbury Rectory, Newport Pagnell), who, having bought shares in the Corporation in 1921, having received no dividends up to 1926, and having failed, as he alleged, to obtain a satisfactory explanation, had reported the matter to the police.

In cross-examination, witness agreed that among the documents sent to him by the Corporation in 1926 there was a balance-sheet, and Counsel pointed out that this balance-sheet was a reply to witness's request for an explanation. It was made clear by the documents sent, said Counsel, that dividends were to be paid out of profits, but the balance-sheet showed that no profits had been made, so that witness was not entitled to any dividends. Also, it was clear that no fees had been paid to any Director, or to any engineer or anybody else. Yet, he said, witness had bundled the papers off to Scotland Yard, and he (Counsel) asked why. Witness replied that he had considered the position unsatisfactory, upon which Counsel commented that they would all be in prison if many people did that sort of thing. When he was pressed to say why he had considered the position unsatisfactory, witness said he had read the London newspapers on the previous day; but he did not indicate what they had contained.

In re-examination, witness said the balance-sheet referred to had shown an excess of liabilities over assets of £2512.

Evidence having been given by a representative of the Registrar of Joint Stock Companies, with regard to the registration of the Corporation, its objects, &c., Mr. W. MacDonald Mackey, F.I.C. (Analytical and Consulting Chemist, of Leeds), who tested samples of the fuel, was recalled for cross-examination on his evidence that he had found the calorific value of the chalk fuel to be 9050 B.Th.U. per lb., and that whereas in his report he had stated also that the calorific value of coal ranged from 12,000 B.Th.U. per lb. upwards, the reference to coal was omitted from that report when published by the Corporation. Replying to Mr. Valetta, witness said he did attach importance to the comparison of the calorific values of the chalk fuel and coal in his report. It was pointed out by Counsel that a second test made by witness had shown the calorific value of the chalk fuel to be 7900 B.Th.U. per lb.; but, though the contrast between the calorific value of the chalk fuel and of coal was greater in this case than in the previous case, no reference was made, in his report, to the calorific value of coal. Witness replied that probably, having mentioned it in his first report, he had not thought it necessary to mention it a second time.

Questions were put by Counsel as to whether, assuming that the sample which was shown to have a calorific value of 9050 B.Th.U. per lb. had contained 10 p.ct. by weight of tar, the addition of another 5 p.ct. of tar would have increased the calorific value. Witness agreed that that would increase the calorific value considerably.

Mr. George Henry Franklin (Mechanical Engineer), who tested the steam-raising properties of the fuel in 1914, and reported adversely upon it, then gave evidence for the prosecution. This was to a large extent corroborative of Counsel's statement at the previous hearing. He told how he had carried out tests in stationary boilers and in a locomotive, both of which tests had proved unsatisfactory; and he had reported to that effect. There was no truth in the laudatory reports published by the Corporation, over his name. Furthermore, he was stated in those published reports to be a Member of the Institution of Marine Engineers, whereas in fact at the time he had made the tests, in 1914, he was an Associate Member, and did not become a Member until 1921. He was also said to be an Associate Member of the Institution of Mechanical Engineers, whereas in fact he was not; though he had been at one time a candidate, he had dropped the matter. The reports he had made, stating that the fuel was very unsatisfactory for steam raising, he had handed personally to Mr. Hollis (who had asked him to make the tests), to be handed to Col. Eaton.

Mr. Valetta said that Col. Eaton had never had the reports.

Witness said that he had made the arrangements for the locomotive test with Col. Eaton and Mr. Hollis. He had seen Col. Eaton after the railway test, and Col. Eaton had said that the report was no good to the Company. Witness's reply was that he could not help that; it was his report on the fuel. He did not think he saw the report at that interview. He had never yet received his fee or expenses for the test.

The cross-examination of Mr. Franklin, which, it was indicated, would be lengthy, was postponed until the next hearing.

Another witness was Mr. K. M. Harrison (Deputy Accountant at the Cannon Street Branch of the Midland Bank) who gave evidence with regard to the Corporation's account. The account was operated by three signatures—*i.e.*, one Director, one of the Joint Secretaries, and the Advisory Engineer. Col. Eaton was the Advisory Engineer.

At this stage the proceedings were adjourned until Wednesday, Nov. 30.

MISCELLANEOUS NEWS.

WOKINGHAM GAS-WORKS INQUIRY.

Application by the Corporation for a Special Order.

In addition to natural advantages of no mean order, and a long and interesting history, the Borough of Wokingham, in Berkshire, possesses a small but well directed and conveniently arranged gas undertaking, in connection with which a progressive policy is meeting with its reward. At the present time, the output is round about 52 million c.ft. per annum; and the increase has been at a rapid rate. The securing of up-to-date provisions of various kinds, which the Town Council now have in view, will doubtless ensure the maintenance of this progress. But a growing business calls for extended facilities; and it was this fact which led to an inquiry being held in the Town Hall, Wokingham, on Thursday, Nov. 10, by Mr. J. F. RONCA (Director of Gas Administration to the Board of Trade), who was accompanied by Mr. H. L. Spencer. The Corporation had made application for a Special Order under section 10 of the Gas Regulation Act; and the local inquiry was in order to afford certain objectors to the erection of a holder on a scheduled site an opportunity of stating their case. As frequently happens on such occasions, however, when the time of hearing arrived, there was no great amount of objection raised.

Mr. J. H. ELLISTON CLIFTON (Town Clerk) explained the case for the Corporation; while other interests were represented by Mr. W. J. BREACH (Secretary to the Ancient Order of Foresters) and Mr. A. B. MARSH (one of the Assistant Solicitors to the Southern Railway Company). Admiral Eustace (six years Mayor of Wokingham) was there to welcome the Director, and there were also present Mr. W. T. Martin (Chairman of the Gas-Works Committee), Mr. W. P. Tucker (Gas Manager), Mr. C. T. May (Secretary), and Mr. C. W. Marks (Borough Surveyor).

The TOWN CLERK explained that the Corporation were making the application for a Special Order primarily to obtain sanction for the purchase of scheduled land in the neighbourhood of Gipsy Lane, upon which it was proposed to store gas. In addition, however, to the erection of the holder, opportunity was being taken to ask for a number of clauses which the Gas-Works Committee considered would be useful—up-to-date clauses referring to various matters affecting the undertaking. The Corporation had inserted in the draft Order power to borrow the sum of £2000 for the purchase of the land, and also the costs of the Special Order. A resolution of the Town Council which was passed on June 6 last authorized the inclusion of certain other sums—£6000 for the new gasholder, £1000 for foundations for the holder, £1000 for past capital expenditure, and £300 for cookers and meters. As a result of the objection lodged by the Southern Railway Company, correspondence had taken place; and an agreement had been arrived at on two clauses which it was proposed to insert in the Order for the protection of the Railway Company. Some doubt, however, had been raised as to whether the exact form of words agreed upon would be acceptable to the Board of Trade. The Ancient Order of Foresters objected as owners of cottage property adjoining the land which the Corporation proposed to acquire for the new holder. The nearest point of their premises would, however, be over 100 ft. distant. But besides claiming that the erection of the holder would depreciate the value of their property, the Foresters objected that, in consequence of the peculiar characteristics of the site, damage might ensue from the carrying out of the foundation work. They asked that an adequate amount should be paid by reason of depreciation, and that assurance should be given that if the buildings were affected the damage would be made good. As an alternative they suggested that the Corporation should buy the property. They added that they had no idea of hampering the Corporation. One could quite well understand their anxiety in this respect; and it was necessary that

the Corporation should satisfy them. The Borough Surveyor would state that there was no need whatever for apprehension. The excavation would be shallow, and could not possibly affect the property in question.

The BOROUGH SURVEYOR said the holder would be placed in a valley, with the land falling towards it. Two trial excavations had been made close to the proposed site of the holder; and solid clay had been encountered from a depth of 3 ft. downwards. He saw no reason at all to anticipate that the stability of the cottages would be affected by this work.

Alderman HUGHES pointed out that the land on which the cottages were built had been originally dug out as a sand pit, and then filled in with rubble. They had already been under-pinned.

The TOWN CLERK remarked that, if the Board of Trade thought fit, the Corporation would give an undertaking that in the event of anything happening to these cottages owing to these excavations—which they did not think could possibly occur—the damage would be made good.

Mr. BREACH said the Foresters did not wish to stress this point too greatly. The matter to which they wished particularly to draw attention was that the erection of the holder would depreciate the value of the property.

Mr. RONCA said he quite appreciated the objection that the property might be adversely affected; but there was also another aspect of the question—namely, whether the land referred to was suitable for the erection upon it of a holder.

Mr. BREACH remarked that he felt, from what he knew of the Corporation, that they would look after the engineering side of the matter.

Mr. TUCKER, answering questions by the Director, stated that the holder would have a capacity of 150,000 c.ft., which was the same as the existing one; and, also like it, the tank would be entirely above ground.

Mr. RONCA: Have you had any trouble with the existing holder?

Mr. TUCKER: None whatever, as far as the foundations are concerned. It has been erected 37 years, and is beginning to show signs of decay.

Mr. MARSH, after examining the following clause, which the Board of Trade proposed to insert in the Order, said he was quite satisfied with it:

> Provided that no such main, pipe, or culvert shall be laid down in any street without the consent in writing of the persons having the control or management of the street, or being responsible for the repair thereof, having been first obtained. But such consent shall not be unreasonably withheld; and any difference arising between the Corporation and such persons shall be determined by arbitration in manner provided by the Arbitration Act of 1889.

This concluded the hearing; and the Director proceeded to inspect the proposed site of the holder.

GAS ENGINES.

Lecture by Mr. W. E. Stevenson, of the National Gas Engine Company, Ltd.

On Nov. 15 Mr. W. E. Stevenson, of the National Gas Engine Company, Ltd., gave an address on gas engines before an attendance of about sixty at the showrooms of the Leamington Priors Gas Company.

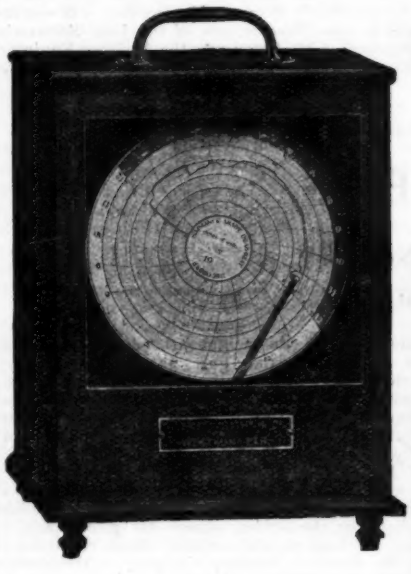
Mr. Stevenson said that it was not necessary for him to go through the earlier experimental stages of the internal combustion engine. It was in 1823 that an engine was designed and actually sold for commercial purposes, so that the gas engine had been in use for over 100 years. Having explained the Otto cycle, he said that the original system of ignition was flame or slide, but before very long tube ignition was introduced. These tubes were of nickel or iron, and heated to a bright red heat by a bunsen flame. Porcelain tube ignition was afterwards introduced working on a similar principle, but more efficient and economical in consumption of gas. There were thousands of engines in use to-day fitted with porcelain tube ignition. Magneto ignition had come along later; low tension being used for large engines and high tension for smaller ones. The advantage of the magneto was that it would fire the weakest charge of gas, as the spark took place in the combustion chamber.

During the past few months his Company had adopted as standard practice an entirely new design of high-tension ignition. This magneto had only one moving part, and was guaranteed for ever against defects. It was damp-proof. In fact, it would function with a stream of water flowing over it.

The undue booming of the electricity industry, and the Press campaign, which had led the public to anticipate in the near future they might be able to obtain electricity at a fraction of the prices ruling, had had the effect of causing manufacturers and others to imagine they were to get light and power for next to nothing. Even the recently-appointed Chief Engineer to the Central Electricity Board, Mr. Page, had found it necessary to state in public that no appreciable reduction in the price of current for industrial and urban districts could be expected for many years to come.

Any medium-sized gas engine would produce 10 B.H.P.-hour with a consumption of one therm of gas. If they assumed, therefore, a power unit of 60 B.H.P. was to be installed working on a constant average load of 45 B.H.P. for 47 hours per week, the total consumption of gas would be 10,000 B.Th.U. (0·1 therm) × 45 H.P. × 47 hours = 211·5 therms, which at 8¾d. per therm would cost (*less* 12½ p.ct. to power users) £6 15s.

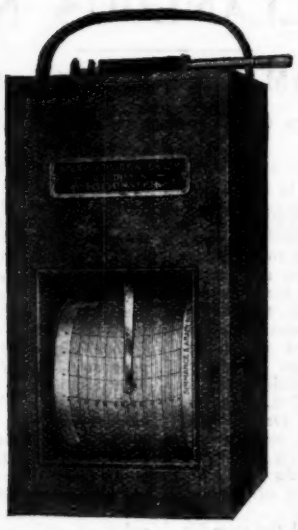
To-day gas engines could be started with the same ease and rapidity as electric motors. Considering the cost of running a 60-H.P. motor under the same conditions, with a 75 p.ct. load factor, the

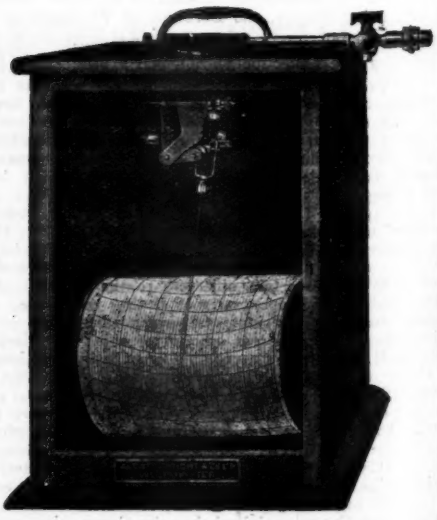


PORTABLE RECORDERS

(SIMMANCE PATENT DEAD BEAT).

IN MANY RANGES FOR ALL PURPOSES.





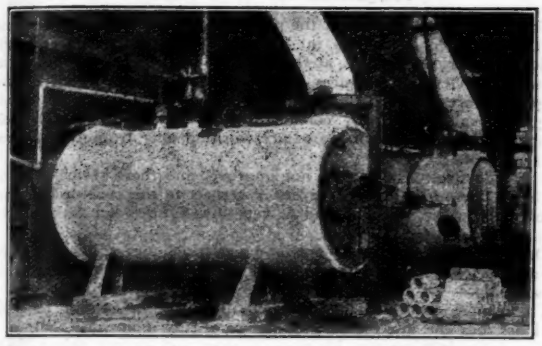
Sole Licensees:

ALEX. WRIGHT & CO., Ltd.

WESTMINSTER, S.W. 1.

Telephone: Victoria 1207. Telegrams: Precision Sowest London.

KIRKE
PATENT WASTE HEAT BOILERS
working on a WATER GAS PLANT at Yokohama



A battery of 3 Kirke Patent Waste Heat Boilers installed for a Japanese client. An excellent example of turning waste into profit.

WHY
have we obtained such satisfactory results for owners of Water Gas Plants?

BECAUSE
there is

1. COMPLETE COMBUSTION
of the "Blow" Gases.

2. NO PRIMING
because the boiler is horizontal.

3. NO LEAKAGE
at inlet tube-plate because scale cannot fall on the inlet tube-plate as in the case of a vertical boiler.

4. SAVING OF SPACE
because the boiler is elevated.

5. TUBES ARE EASILY CLEANED
on both sides.

Write to us for full particulars:

SPENCER-BONECOURT LIMITED

50-64 BROADWAY, WESTMINSTER, S.W.1.
'Phone: VICTORIA 2802-3.

O. & S.

efficiency of an electric motor would be 87 p.ct., so that the consumption of current would be 746 × 100 divided by 87 = 0·86 unit. Thus, for 45 B.H.P. for 47 hours per week, the total consumption would be 1818 units, which at 2d. per unit would cost £15 3s., and at 4d. per unit would cost £30 6s.

Shafting and drives should be examined by gas engineers in every case, and advice given to the users as to how to obtain the most efficient results. If the shafting was in perfect alignment, and the bearings were in good condition, it was surprising what a small percentage of power was lost.

CO-PARTNERSHIP AT RYDE.

The inauguration of a scheme of co-partnership among the employees of the Ryde Gas Light Company was marked by a high tea, at the invitation of the Directors, in the Foresters' Hall, on Tuesday, Nov. 15, when about 125 men and their wives were present. The Chairman of the Company (Mr. F. W. Randall, J.P.) presided, and, after welcoming the guests, proceeded to explain the benefits of the co-partnership system. He remarked that the Company had something like 75 permanent employees, who were a worthy, loyal, and industrious body of men. The co-partnership scheme would tend to increase this spirit of loyalty, and add to the interest taken by them in their daily work. Nothing in the rules could prejudice the status of the men in any way; there was no "snag" in co-partnership. The scheme would be worked by a Committee of seven, comprising the Deputy-Chairman, three members elected by the Directors and three appointed by the employees, representing respectively the staff, the works, and the distribution department.

The proportion of profits to be distributed was made up in the following way: At the end of the financial year which, on the first occasion, would be after their annual general meeting in August, 1928, a sum representing 5 p.ct. on the total dividends that had been paid during the previous year would be placed at the disposal of the Committee, together with a further sum of £50 for every penny per therm gas was reduced below 14d. per therm down to 10d. The present price was 13d. per therm; and they were hoping there would be a further reduction. The sum appropriated as profit depended upon the amount of dividend the shareholders received. The larger it was, the more would go to their fund; and as gas was reduced, the more would be consumed, giving them a direct interest in keeping the price as low as possible. In special circumstances the amount of 5 p.ct. might, with the approval of the stockholders, at the annual meeting, be increased to 6¼ p.ct. Anyhow this sum, which roughly, at a low estimate, would come to not less than £500 at the end of the year, would be divided in equal parts between the 75 adult co-partners, so that each of them would get £6 a year. Of that sum the rule provided that £3 should be looked upon as non-withdrawal bonus, that was to say, it was entered in their pass-books and went forward until there was sufficient money to pay a £10 share. The stockholders had passed a resolution voting £500 with which to commence the scheme. There was therefore little doubt that there would be quite enough for each co-partner to purchase £10 of stock so as to become an actual shareholder, and, in the following year, draw dividends. The other £3 could be taken in cash; but it would be to the great advantage of the men to invest all the money. On this basis, a man aged 25 would, at 65, after dividends, &c., had accrued, receive £724; and if he took the withdrawal bonus and allowed the rest to accumulate, he would have £362. But, on the other hand, if he took all he could get, and drew his dividend and interest each year, he would have only £120.

Mr. Fred W. Taylor (Engineer and Secretary) said he had been able to purchase £100 of stock on behalf of the co-partners to start with.

A hearty vote of thanks was passed to the Chairman, Directors, and proprietors.

Lower Prices at Redcar.—It has been decided to increase the discount for gas consumed in the quarter commencing next January to 33⅓ p.ct. The increases in discount made since September last are equivalent to a reduction of 6½d. per 1000 c.ft.

Cupar Gas Company's Water Rates.—The Appeal Committee of the Town Council heard an appeal by the Cupar Gas Company against being rated on their rental for water instead of by meter as formerly. Last year they paid for water £19 9s. 10½d.; this year the demand note was for £80 0s. 8d. Mr. R. Osborne Page, W.S., who appeared for the Gas Company, stated that the Company at present pumped all the water they required for commercial purposes from the Ladyburn. If the new rating was to be insisted upon, his clients would at once cease pumping, and take from the Cupar supply all the water they required, which would amount to considerably over 1 million gallons per annum. The appeal was dismissed.

Gas from the Ruhr.—According to a recent issue of the "Financial Times," the German Dye Trust has decided to obtain the whole supply of gas needed for its great works at Leverkusen direct from the Ruhr district. The question of the advisability of producing gas in the neighbourhood of the pits and distributing it by a system of pipes to consumers in the Communes and industrial centres, even at a considerable distance, has been discussed for years, but hitherto no definite steps have been taken to settle it. Though the Dye Trust possesses at Leverkusen a modern gas-producing plant and an excellent organization for the supply of gas coal, these are to be closed down, for the Trust has calculated that, including the cost of transformations necessary to permit of heating and firing with gas, it will be cheaper to bring the whole supply, which amounts to about 15 million cub.m. annually, from the coal district. The requisite contracts with the Thyssen Company for the exploitation of coal are not yet signed, but it is credibly reported that negotiations are nearing conclusion.

SHEFFIELD GAS COMPANY'S WAR MEMORIAL.

Unveiling Ceremony on Nov. 11.

A memorial to the 58 employees of the Sheffield Gas Company who fell in the war was unveiled and dedicated on Nov. 11 in the presence of relatives and friends of the fallen, Directors of the Company, and numerous employees.

The memorial, which has been let into the wall of the entrance hall at the offices in Commercial Street, is a beautiful piece of Italian mosaic work, and consists of three white marble tablets bearing the names of the deal in black letters, and surmounted by a semi-circular blue marble slab suitably inscribed.

Lieut.-Col. H. K. STEPHENSON, D.S.O., V.D., Chairman of the Gas Company, said that no fewer than 551 of the Company's employees proceeded on active service. During the war Sheffield became a vast arsenal, and the resources of the Gas Company were strained almost to breaking-point to supply the quantity of gas required. They had in their employ at the commencement of the war 1589 persons, and when the war ended that number had grown to 1700, of whom 263 were women, who rendered splendid service. In 1913, the last full year before the war, the undertaking supplied 4500 million c.ft of gas, while in 1917, the last full year of the war, the

quantity had increased to nearly 6000 million c.ft., which involved the carbonizing of no less than 513,000 tons of coal. From 1915 to the end of the war they supplied to the Government something like 1,500,000 gallons of toluole, for which special plant was erected.

DISCUSSION AND ARBITRATION.

Referring to the memorial, Col. Stephenson said the remembrance of the 58 men who gave up their lives was indelibly engraved on the hearts of those who were left behind. "Though we are rather disappointed with the fruits of our victory, which have not come up to our expectations, still, there is no cause for despair," he said. "Internationally, I think we may, not unreasonably, hope to see the nations of the earth more ready to settle their disputes and differences by discussion and arbitration through the medium of the League of Nations, and correspondingly more unwilling to resort to the arbitrament of arms. In spite of our National Debt, high taxes, and unemployment, resulting from the high cost of production, we can still hold up our heads and look the world in the face, because we are making these heavy sacrifices for the sake of honesty, in order to pay our debts."

Col. Stephenson also alluded to the cheerful sign of peace and co-operation in industry, to which, he said, the Company had never been strangers.

After he had withdrawn the Union Jack, revealing the tablet to view, a brief silence was observed, and buglers of the York and Lancaster Regiment sounded the "Last Post."

The BISHOP OF SHEFFIELD (Dr. Burrows), before dedicating the memorial, delivered an address.

The dedication was followed by the sounding of the "Reveille" and the singing of "O God, our help in ages past," and a verse of the National Anthem.

After the pronouncement of the Benediction by the Bishop, a number of wreaths were deposited below the memorial by representatives of the various departments, and there was an inspection of ex-Service-men.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

There is very little animation or movement in the market, and during the past week there has been a tendency in some directions towards lower prices. Only in a few instances of special brands is there any real demand, and few collieries are full up for any distance ahead. The inquiry from abroad remains disappointing, and many orders for which quotations are given go to the Continental producers, presumably at still lower figures than we can quote.

The better makes of gas coals are fairly well placed for early shipment, but seconds can do with more trade. Latest nominal quotations are 15s. 9d. f.o.b. for best qualities, 16s. for Wear Specials, and 13s. 9d. to 14s. for seconds. Durham coking is called 13s. 6d. to 14s., but is in slow demand, and is being offered forward at less than this. Best Durham unscreened steam is fairly firm at about 14s. 9d. to 15s. 6d., according to place of shipment, and some brands are even asking 15s. to 16s. Seconds quote 13s. 6d. to 13s. 9d. Northumberland steams ask 13s. 6d. for best screened sorts, and are obtainable at slightly less through second hands.

Gas coke continues in good demand, and is well booked at 24s. 6d. to 25s. f.o.b. for shipment.

YORKSHIRE AND LANCASHIRE.

The rather wild weather of the past week has retarded any increase in the house coal business in Yorkshire and Lancashire, and the majority of prices are still at the summer level, though in some instances the October advances have been maintained. Many of the larger pits are working four to five days per week, but only by cutting their sale prices very considerably. Many of the smaller collieries not in a position to do so are working only from two to three days a week.

The industrial outlook does not improve, and there seems to be no settled policy on the part of buyers in respect to the coal trade. Fuel of all descriptions is to be had at very low figures—much below the cost of production.

One or two gas contracts are in the market, and will no doubt be fixed at prices less than those operating during the summer, low as these were.

The export section reports minute progress in regard to small business, but the affected tonnage is not of any moment.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports: South Yorkshire—Hards, Association, 16s. 6d. to 16s. 9d.; screened gas coal, 16s. to 17s.; washed trebles, 16s. 6d. to 17s.; washed doubles, 15s. to 15s. 3d.; washed singles, 15s. to 15s. 3d.; washed smalls, 10s. 3d. to 10s. 6d.; rough slack, 8s. 9d. to 9s.; smithy peas, 17s. to 18s. per ton. West Yorkshire—Hartleys (f.o.b. Goole), 14s. 6d. to 15s. 6d.; screened gas coal, 14s. 6d. to 15s. 6d.; washed trebles, 16s. 6d. to 17s.; washed doubles, 14s. 6d. to 15s.; washed singles, 14s. 6d. to 15s.; washed smalls, 10s. to 10s. 6d.; unwashed trebles, 15s. 6d. to 16s.; unwashed doubles, 11s. 6d. to 12s.; rough slack, 9s. to 9s. 3d.; coking smalls, 8s. 3d. to 8s. 6d. per ton. Derbyshire and Nottinghamshire—Top hards, 16s. to 18s.; washed doubles, 15s. to 15s. 6d.; washed singles, 14s. 9d. to 15s.; washed smalls, 10s. to 10s. 6d.; unwashed doubles, 12s. to 12s. 6d.; rough slack, 8s. 9d. to 9s. per ton. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 14s. 6d. to 15s.; gas coke, 25s. to 25s. 6d.; furnace coke, 18s. per ton.

In Lancashire, the market has a weak tone, and the demand is slow. Quotations: Lancashire best house coal, 31s. to 32s.; seconds, 25s. to 26s.; common, 19s. to 20s.; kitchen, 23s. to 24s.; Yorkshire best selected house, 32s. to 35s.; best house, 30s. to 31s.; seconds, 18s. to 19s.; washed doubles, 13s. to 14s. 6d.; washed singles, 8s. to 9s.; rough slack, 7s. 6d. to 8s. 6d. per ton in wagons at pit.

MIDLANDS.

The pits are working at not much more than half-time in the majority of cases. As a result of the "cold snap" a good deal of household coal which had been held up in transit was moved. The hard weather, however, did not last long enough to make much impression on the stocks at wharves. Enough wagons have been released to deal with a big tonnage; but with the industrial demand showing no signs of expansion, many collieries are more concerned about reducing the accumulations of coal at the pithead than about increasing production.

There is little change in the basis of market values. Concessions which were formerly obtainable by buyers of some descriptions of house coal have now been withdrawn, but list prices are not easily enforceable. On the industrial side there is still weakness owing to the offer of spot lots on terms below the recognized level. Nuts, beans, and various grades of steams have fluctuated rather widely. There are indications, however, that a sounder balance is being restored between supply and demand. Slacks are less plethoric; the main factors in bringing this about being the requirements of the electricity stations and increased consumption for heating purposes.

Hard furnace cokes are still in over-supply, and prices are from 12s. upwards at ovens.

Mr. C. S. Shapley, the Leeds City Gas Engineer and General Manager, was one of the most indefatigable workers in the successful raising of a great Leeds convoy of supplies for the assistance of the people of Fleetwood distressed by the recent grievous tidal flood there. The convoy, which left Leeds on Nov. 16, comprised nearly fifty motor vehicles, with about £2000 worth of goods of many kinds, in addition to which there was a sum of £650 which had been collected in money.

STOCK MARKET REPORT.

STOCK Exchange business was decidedly quieter last week. The gilt-edged market continued to be adversely affected by new issues, and the strength of sterling failed to counteract this influence. The large part of the business done was in the Industrial Market, but prices fluctuated a good deal in the absence of consistent support.

The surprise of the week was the success of the Kenya 5 p.ct. loan. Issued at 99⅜, the amount was oversubscribed, and at the time of writing dealings are at a premium of 1 1/16 p.ct. Considerable interest is also being taken in the prospects of the Brighton 4½ p.ct. offer at 97½, which without redemption value realizes only £4 17s. 5d. p.ct.

The transactions recorded in the Gas Market were rather more than usual. Prices continue to improve, but, speaking generally, are still below the figures reached in the year 1924. Brighton and Hove consolidated were again prominent; and it will be seen that there were dealings in all the principal stocks. The quotations shown in the Table for the Sheffield three stocks have for many years been the local exchange figure. In the absence of transactions, the London quotations have been much lower; but last week this was adjusted, and the London quotation raised 6 points to 101-104. The Stock Exchange would welcome notification of any apparent discrepancies of this nature.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Nov. 18.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices.
£			% p.a	% p.a.				
171,978	Stk.	Sept. 8	5	5	Aldershot 5 p.c. max. C.	68—73	..	..
329,992	,,	,,	4	4	Do. 4 p.c. Pref.	67—70	..	..
1,551,868	,,	Sept. 29	7	7	Alliance & Dublin Ord.	90—94	+1	69—70
274,000	,,	July 14	4	4	Do. 4 p.c. Deb.	64—67	..	91—92½
522,654	,,	Aug. 25	—	7	Barnet Ord. 7 p.c.	102—105	..	..
300,000	1	Oct. 13	1/7½	1/7½	Bombay, Ltd.	21/6—23/6	..	103⅝—104⅜
170,000	10	Aug. 25	8½	8½	Bournemouth 5 p.c.	12⅛—13⅛	..	21/9
500,050	10	,,	7	7	Do. B 7 p.c.	12—12½	..	..
275,000	10	,,	6	6	Do. Pref. 6 p.c.	10⅜—11⅛	..	12⅛—12 7/16
50,000	Stk.	June 29	3	3	Do. 5 p.c. Deb.	55—58	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	75—78	..	..
357,900	,,	Aug. 25	—	7½	Brighton & Hove 6 p.c. Con.	108—111	+1	108½—102⅜
341,800	,,	,,	—	6/8/6⅔	Do. 5 p.c. Con.	96—99	+2	..
1,387,500	,,	July 28	5	5	Bristol 5 p.c. max.	86⅛—87⅛a	+⅛	..
855,000	,,	Sept 29	7	8	British Ord.	109—112	..	110½—112
100,000	,,	June 29	7	7	Do. 7 p.c. Pref.	114—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	74—77	..	..
200,000	,,	,,	—	88/2	Do. 5 p.c. Red. Deb.	95—98	+1½	..
100,000	10	May 26	6	8	Cape Town, Ltd.	7⅛—8½	..	..
100,000	10	Oct 27	4½	4½	Do. 4½ p.c. Pref.	6—7*	..	..
150,000	Stk.	June 29	4½	4½	Do. 4½ p.c. Deb.	70—75	..	..
236,860	,,	July 28	6	6	Cardiff Con. Ord.	100—103	..	74—75
237,860	,,	June 29	7½	7½	Do. 7½ p.c. Red. Deb.	103—106	..	..
157,150	,,	Aug. 11	6½	5	Chester 5 p.c. Ord.	87—92b	..	..
79,185	1	Oct. 13	12/-	12/-	Colombo Ltd. Ord.	28/—30/-	..	..
24,495	1	,,	1/4⅜	1/4⅜	Do. 7 p.c. Pref.	20/—22/-	..	..
321,490	1	Oct. 13	1/9⅜	1/9⅜	Colonial Gas Assn. Ld. Ord.	24/—26/-	..	..
178,900	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	25/1½
2,073,280	Stk.	July 14	—	5	Commercial Ord.	91—93	..	21/3
475,000	,,	June 16	8	8	Do 8 p.c. Deb.	56—59	..	92½
300,000	,,	Sept. 29	‡1	‡1	Continental Union, Ltd.	30—35	..	..
787,560	,,	,,	7	7	Do. 7 p.c. Pref.	83—86	..	..
403,100	,,	Aug. 11	6½	6½	Croydon sliding scale	98—101	..	..
492,270	,,	,,	5	5	Do. max. div.	80—88	..	99½—100½
55,000	,,	Aug. 25	9	6	Derby Con.	108—105e	..	21
200,000	,,	June 29	4	4	Do. Deb.	73—75e	..	..
50,000	,,	Aug. 25	5	5	East Hull Ord. 5 p.c.	78—81	..	..
1,009,180	,,	June 16	5	5	Eastbourne 5 p.c. Deb.	90—95	..	..
5,747,480	10	Sept. 29	13	††4	European, Ltd.	6⅞—7½	..	..
2,400,000	Stk.	July 28	5	5	Gas Light & Coke 4 p.c. Ord.	89—91	..	6⅞—7⅛
4,187,090	,,	,,	8½	8½	Do. 8½ p.c. max.	61—68	..	89—89⅞
5,828,830	,,	,,	4	4	Do. 4 p.c. Con. Pref.	76—79	..	61⅞—69⅜
181,315	,,	June 16	8	8	Do. 3 p.c. Con. Deb.	59⅛—61⅛	..	76¼—78
1,642,770	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	102—105	..	60⅛—61⅛
49,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	99—101	..	102
93,500	,,	—	7⅛	7⅛	Do. 7⅛ p.c. Ilford Deb.	..	..	100⅜—100⅞
268,740	,,	Aug. 25	6⅜	6⅜	Hastings & St L. 5 p.c. Conv	88—91	..	..
70,000	,,	,,	5⅛	5⅛	Do. 3½ p.c. Conv.	72—75	..	..
173,200	10	Oct. 13	†10	†10	Hongkong & China, Ltd.	12—13	..	..
1,976,000	Stk.	Aug. 25	5	5	Hornsey Con. 3½ p.c.	70—73	..	..
233,180	,,	Nov. 10	10	10	Imperial Continental Cap.	140—143*	..	..
235,942	,,	Aug. 11	8½	8½	Do. 8½ p.c. Red. Deb.	68—70	..	140—142
2,145,907	,,	Aug. 11	6½	7	Lea Bridge 5 p.c. Ord.	94—97	..	..
800,000	,,	Aug. 11	5½	5½	Liverpool 5 p.c. Ord.	87½—88½b	..	..
185,786	,,	Sept. 29	7	7	Do. 7 p.c. Red. Pref.	101—103b	+1⅜	..
75,000	,,	Aug. 25	8	9	Maidstone 5 p.c. Cap.	107—112	..	..
541,920	5	June 16	†7	†8	Malta & Mediterranean	5½—5⅞	..	..
2,061,315	Stk.	May 26	†5	†7	Montevideo, Ltd.	91—93	..	..
260,929	,,	July 28	5	5	Newcastle & Gateshead Con.	75—76½d	-1⅜	..
691,705	,,	,,	4	4	Do. 4 p.c. Pref.	67⅛—68½d	-2	..
131,785	,,	June 29	8½	8½	Do. 8½ p.c. Deb.	66⅜—67½d	..	..
800,000	,,	Aug. 25	—	6/18/0	North Middlesex 6 p.c. Con.	93—96	..	..
188,120	,,	Apl. 28	9	7	Oriental, Ltd.	100—102	..	..
414,500	,,	June 21	7¼	7⅜	Plym'th & Ston'house 5 p.c.	105—110	..	101½
236,732	,,	Aug. 25	7½	7½	Portsm'th Con. Stk. 4p.c. Std.	102—105	..	..
2,269,909	,,	,,	5	5	Do. 5 p.c. max.	76—79	..	..
389,200	1	—	—	—	Primitiva Ord.	20/9—21/9	+1/-	20/—21/7½
800,000	100	June 1	4	4	Do. 4 p.c. Red. Deb.	84—86	..	..
434,968	Stk.	July 28	4	4	Do. 4 p.c. Red. Deb. 1911	72—74	..	..
150,000	,,	June 29	—	4	Do. 4 p.c. Cons. Deb.	72—74	..	..
125,000	10	Sept. 29	6	6	San Paulo 6 p.c. Pref.	7⅞—8½	..	78½
370,000	50	June 29	5	6	Do. 5 p.c. Red. Deb.	47—49	..	..
419,968	Stk.	Sept. 8	5⅜	5	Sheffield A	102—104e	..	..
1,047,000	,,	,,	5⅜	5⅜	Do. B	102—104e	..	..
90,000	,,	,,	5½	5½	Do. C	102—104e	..	..
6,609,895	10	May 26	4	6	South African	4—6	..	..
500,000	Stk.	Aug. 11	7	5	South Met. Ord.	102—104	..	..
1,895,445	,,	—	—	—	Do. 6 p.c. Irred. Pf.	110—113	..	102½—103¾
784,000	,,	July 14	8	8	Do. 8 p.c. Deb.	58—61	..	60
91,500	,,	Sept. 8	6½	6½	Do. 6½ p.c. Red. Deb.	102—104	+1	102½—103
1,243,795	,,	Aug. 11	8½	8½	South Shields Con.	101—103d	..	..
868,837	,,	July 28	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	104
647,740	,,	June 16	5	5	Do. 5 p.c. Deb.	93—96	..	..
121,375	,,	Sept. 8	5	5	South'mpton Ord. 5 p.c. max	75—78	..	..
250,000	,,	June 29	4	4	Do. 4 p.c. Deb.	73—76	..	76½—77½
300,000	,,	Aug. 25	7	7	Swansea 7 p.c. Red. Pref.	103—106	..	..
120,000	,,	June 16	6½	6½	Do. 6½ p.c. Red. Deb.	100—103	..	104—104½
582,275	,,	July 28	7½	7½	Tottenham District A 5 p.c.	105—108	..	..
150,000	,,	,,	6½	6½	Do. B 3½ p.c.	89—92	..	107
191,255	,,	June 16	5½	5½	Do. 5½ p.c. Pref.	95—98	..	90⅜—91½
238,251	,,	Sept. 29	5	5	Do. 4 p.c. Deb.	72—75	..	..
289,094	,,	Aug. 25	6½	6½	Tynemouth Con. and New	81—83d	..	..
88,320	,,	,,	5	5	Uxbridge, Maidenhead, & Wycombe 5 p.c.	85—90	..	..
30,000	,,	July 14	8½	8½	Do. 5 p.c. pref.	88—88	..	..
305,686	,,	,,	7	7	Wandsworth, Wimbledon, and Epsom—			
432,635	,,	,,	5/19/0	5/19/0	Wandsworth A 5 p.c.	125—130	..	..
352,000	,,	,,	6½	6½	Do. B 3½ p.c.	105—110	..	..
98,000	,,	,,	7½	7½	Do. C and New	90—95	..	..
200,000	,,	,,	5	5	Do. Wimbledon 5 p.c.	100—105	..	..
86,416	,,	,,	8	8	Do. Epsom 5 p.c.	107—112	..	..
284,743	,,	June 29	4	4	Do. 5 p.c. Pref	85—90	..	..
		,,			Do. 8 p.c. Deb.	56—59	..	..
					Do. 4 p.c. Deb.	74—77	..	57½

Quotations a :—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle e.—Sheffield. * Ex. div. † Paid free of income-tax. ‡ For year.

On Monday, Alliance and Dublin 91⅜, 92⅛, 92½, Barnet 7 p.ct. maximum 103¾, Bournemouth "B" 12⅜, British 110⅜, 112, Croydon sliding-scale 99½, European 6⅞, Gas Light and Coke 89, 89⅛, 89⅜, 89⅞, 4 p.ct. preference 76½, 3 p.ct. debenture 60½, 61, 5 p.ct. debenture 100⅜, 100⅞, Imperial Continental 140½, Primitiva 20s., 20s. 3d., 20s. 4½d., 20s. 6d., 20s. 7½d., 20s. 9d., South Metropolitan 102⅜, Swansea 7 p.ct. preference 104, 104½. Supplementary prices, Colonial 5 p.ct. debentures 90⅜, Eastbourne 3½ p.ct. "B" 105, Waltham and Cheshunt 10 p.ct. "A" 12⅞.

On Tuesday, Aldershot 4 p.ct. preference 69, Alliance and Dublin 91½, Barnet 7 p.ct. 104⅜, British 111, Colonial 25s. 1½d., 8 p.ct. preference 21s. 3d., Commercial 92½, Croydon sliding-scale 100⅜, maximum dividend 81, Gas Light and Coke 89½, 89⅝, 89⅞, 3½ p.ct. 62⅜, 4 p.ct. preference 77, 3 p.ct. debenture 61½, 6 p.ct. Brentford debenture 102, Oriental 101¼, Primitiva 20s. 6d., 20s. 7½d., 20s. 9d., 20s. 10½d., 21s., 21s. 1½d., South Metropolitan 103¾, Tottenham "B" 90⅜, 91½, Wandsworth 3 p.ct. debenture 57½. Supplementary prices, Barnet 4 p.ct. debenture 72, Eastbourne 3½ p.ct. "B" 104⅜, Southend original 83½, 84, 4 p.ct. debenture 70, 70½, Worthing 90.

On Wednesday, Alliance and Dublin 91, Barnet 7 p.ct. 104⅜, Bournemouth "B" 12⅜, British 112, European 6⅞, 7⅛, Gas Light and Coke 89⅛, 89⅜, 89⅝, 4 p.ct. preference 77, 78, 3 p.ct. debenture 60⅜, 5 p.ct. debenture 100⅞, Imperial Continental 140½, Oriental 101¼, Primitiva 20s, 9d., 21s. 1½d., 21s. 3d., 21s. 4½d., 4 p.ct. consolidated debenture 73½, Sheffield "C" 103, South Metropolitan 102½, 102⅜, 3 p.ct. debenture 60, 6½ p.ct. debenture 102½, South Suburban 104, Wandsworth 3 p.ct. debenture 57½. Supplementary prices, Gas Light and Coke, Brentford 7½ p.ct. mortgages 102.

On Thursday, Alliance and Dublin 91½, Brighton and Hove 6 p.ct. 108¼, Cape Town 4½ p.ct. debenture 74, 75, European 7⅛, Gas Light and Coke 89, 89⅛, 89⅜, 89⅝, 89⅞, 3½ p.ct. maximum 61¾, 4 p.ct. preference 77, 77½, 78, 3 p.ct. debenture 61, Imperial Continental 140, 140½, Primitiva 21s., 21s. 1½d., 21s. 3d., 21s. 4½d., 21s. 6d., 21s. 7½d., South Metropolitan 102½, 102⅜, 103¼, 6½ p.ct. debenture 102½, Southampton 5 p.ct. 76½. Supplementary prices, Basingstoke 6 p.ct. preference 98, Brighton and Hove 6 p.ct. "B" preference 108⅜.

On Friday, Aldershot 4 p.ct. preference 70, Alliance and Dublin 91⅝, 92, Bombay 21s. 9d., European 7, 7⅛, Gas Light and Coke 89¼, 89⅜, 89⅝, 3½ p.ct. maximum 62, 3 p.ct. debenture 60½, 61¼, 5 p.ct. debenture 100⅞, Imperial Continental 140, 143, Primitiva 21s., 21s. 1½d., 21s. 3d., 21s. 4½d., South Metropolitan 102½, 102⅜, 103, 6½ p.ct. debenture 103, Southampton 5 p.ct. maximum 77½, Tottenham "A" 107, "B" 91.

Money was plentiful in Lombard Street at the close of the week. New money commanded from 3½ to 3⅝ p.ct.; but balances were offered later at 3 p.ct., and even below that level. Old day-to-day loans remained generally at 3½ p.ct. As was expected, the price tendered for Treasury Bills was higher, and the average rate paid by the Government fell to £4 6s. 8·11d. p.ct., or just over 10d. p.ct. less than the previous week. Business in the discount market was possibly easier in consequence; but there was little or no change in the rate for bank bills.

In the Foreign Exchange Market, Japanese yen were most prominent, the Kobe rate rising to 1s. 10 3/32d. Sterling on New York was slightly cheaper at 4.87 15/32; Italian lire rose 15c. to 89.65; Dutch florins closed 1/16c. higher at 12.06 1/16; but French francs remained unchanged.

There were no changes in either Gold or Silver. The former was nominally 84s. 11½d. per oz., and the latter 26½d. per oz., the forward quotation being slightly cheaper.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2⅝ p.ct. at notice.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON *Nov.* 21.

There is little movement in the London tar products market.

Pitch remains unchanged at about 87s. 6d. to 90s. per ton f.o.b. works.

Creosote is firm at about 9d. per gallon.

Pure benzole is 1s. 5d. to 1s. 6d. per gallon; pure toluole, about 1s. 10d. to 1s. 11d. per gallon; 95/160 solvent naphtha, 1s. 3d. per gallon; and pyridine, 6s. to 6s. 6d. per gallon.

Tar Products in the Provinces.

Nov. 21.

The markets for tar products, although quiet, are steady.

In pitch, there has been a little demand for delivery to the end of the present year, and one or two parcels have been sold at full market prices.

Creosote oil is still very firm for both prompt and forward delivery.

Water-white products are quiet, and without alteration.

For carbolic acid the market is somewhat firmer.

The demand for cresylic acid continues.

For pure naphthalene the makers generally are maintaining their advanced prices.

The average prices of gas-works products during the week were: Gas-works tar, 61s. 6d. to 66s. 6d. Pitch—East Coast, 85s. to 86s. f.o.b. West Coast: Manchester, 80s. to 81s.; Liverpool, 83s. to 83s. 6d.; Clyde, 84s. to 85s. Benzole, 90 p.ct., North, 1s. 1d. to 1s. 2d.; crude, 65 p.ct. at 120° C., 10d. to 10½d., naked at makers' works; 50/90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluole, naked, North, 1s. 4d. to 1s. 5d. nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 9½d. to 10d. Heavy naphtha, North, 10d. to 1s. Creosote, in bulk, North, liquid, 7½d. to 7¾d.; salty, 7⅝d. to 7½d.; Scotland, 7½d. to 7¾d. Heavy oils, in bulk, North, 8¾d. to 9½d. Carbolic acid, 60 p.ct., 2s. 4d. to 2s. 5d. prompt. Naphthalene, £11 to £14; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

CONTRACTS OPEN.

Meters.

The Stockton-on-Tees Corporation invite tenders for the supply of gas meters. [See advert. on p. 567.]

Paint, Oils, Lime, and other Stores.

The Stockton-on-Tees Corporation Gas Department invite tenders for the supply of the above. [See advert. on p. 567.]

Purification Plant Extensions, &c.

The County Borough of Stockport invite tenders for an extension to their coal gas purification plant. [See advert. on p. 567.]

Pipes, &c.

The Stockton-on-Tees Corporation invite tenders for the supply of gas mains and specials, and wrought iron and lead tubing. [See advert. on p. 567.]

TRADE NOTES.

Removal.

Messrs. Spencer-Bonecourt, Ltd., have removed to Broadway Buildings, Broadway, S.W. 1.

Morris Electric Lifts.

Messrs. Herbert Morris, Ltd., of Loughborough, have published a new handbook which deals with electric lifts. Lifts for goods or for passengers are described and illustrated, and there is a liberal section devoted to hand-operated lifts and platform elevators. The firm will forward a copy of the booklet to any of our readers on request.

Pintsch-Otto Intermittent Vertical Chamber Ovens.

Chamber Ovens, Ltd., of 39, Victoria Street, London, S.W. 1 (formerly the Fuel Recovery Syndicate, Ltd.), have been given a contract by the Gas Light and Coke Company for the construction and installation of a 5 million c.ft. per day intermittent vertical chamber oven plant according to the Pintsch-Otto system, for which they are the sole licensees, together with the usual accessory machinery, &c., as well as two retort house waste-heat boilers.

Light from Sand.

An interesting address with the title "Light from Sand" was delivered by Mr. H. Talbot, General Manager of the Welsbach Light Company, Ltd., of King's Cross (whose factory is situated at Broomhill Road, Wandsworth), at a weekly meeting of the Putney Rotary Club. Mr. Talbot, who has devoted many years to the industry with which the Welsbach Company has been associated from its inception, illustrated his remarks by a profuse array of samples and photographs, and a number of experiments which gave point to particular facts he wished to emphasize. The light referred to by Mr. Talbot was, of course, that given by the incandescent gas mantle, first manufactured in England by the Welsbach Company almost exactly forty years ago. He closed his address by exhibiting the largest and the smallest mantles, respectively, which are at the present time commercially manufactured. The first was of approximately 5000 c.p., used for lighthouse work, measuring about 9 in. in height and 6 in. in diameter. The smallest, used in microscopy, was of the inverted type, mounted on a ring; the mantle fabric measuring about ¼ in. long by ⅛ in. wide. A hearty vote of thanks was accorded to Mr. Talbot at the end of the lecture.

Reduction at Stourbridge.—The Stourbridge Gas Department notify a reduction in the price of gas of 3d. per 1000 c.ft., from the end of the December quarter.

Brighton and Hove General Gas Company.—The recent issue by the Company of £50,000 6 p.ct. "B" preference stock was oversubscribed to the extent of £38,100. The minimum price at which tenders were accepted was £105 11s. p.ct. The highest price offered was £108 p.ct.

Grays and Tilbury Share Issue.—On behalf of the Directors of the Grays and Tilbury Gas Company, Messrs. A. & W. Richards, of 37, Walbrook, London, E.C., are making an issue of 2500 £10 "B" ordinary shares, ranking for a standard dividend of 7 p.ct., subject to the sliding-scale. The minimum price of issue is £9 10s. per share, yielding at that price, on the present dividend, 7 p.ct. Tenders are to be sent to the firm by Thursday morning, Dec. 1.

Accident at the Porth Gas-Works.—While some men were discharging an oxide purifier at the Porth Gas-Works of the Rhondda Urban District Council on Thursday, the 17th inst., one of them, in using a pick, must have created a spark which ignited some gas that was underneath, and caused an explosion which set fire to the oxide. Two men were burnt, one rather badly, and were taken to the local hospital, where they are progressing favourably. The local brigade quickly put out the fire. The damage is slight, and is covered by insurance; and the manufacture of gas was continued without interruption.

Flueless Stove in an Unventilated Room.—At an inquiry in Sheffield into the circumstances attending a double fatality, it was stated that the victims—an old woman lying seriously ill, and a man who was sitting up with her—were found dead in an unventilated room, in which a flueless gas stove (partly turned down) connected by a flexible tube, was burning. The gas fire was produced in court; and in answer to the Coroner, Mr. H. Chamberlain (Engineer to the Sheffield Gas Company) said it was of a type that was never fitted by the Company. The Company did not supply or fit stoves unless they had a proper flue outlet to carry away the products of combustion, and a rigid connection for supplying the gas. Medical evidence was to the effect that the cause of death was carbon monoxide poisoning; and the Coroner found that the occurrence was accidental.

Gas Committee Deadlock.—At a meeting of the Manchester Gas Committee on Nov. 14, a difficult situation arose over the election of a Deputy-Chairman; and eventually the meeting was adjourned by the Lord Mayor (Councillor William Davy), who presided, without a Deputy-Chairman having been elected. At the first meeting of the Committee after the 1926 elections, Alderman Cook was elected Chairman in place of Alderman Sir William Kay, and Councillor William Cundiff Deputy-Chairman. Alderman Cook was re-elected Chairman on Nov. 14,; but, as Councillor Cundiff had tendered his resignation from the Committee at the recent meeting of the Nomination Committee, a new Deputy-Chairman had to be found. The candidates concerned were Mr. John Harrison, the Conservative representative of the Levenshulme Ward, and Mr. Joseph Toole, the Labour representative of the Openshaw Ward; and before the meeting was adjourned for a decision to be arrived at at a later date, five ballots were necessary, both candidates on each occasion receiving an equal number of votes.

Smethwick Gas Department Social Club.—A Social and Recreation Club has recently been formed in connection with the County Borough of Smethwick Gas Department. Its inception has met with much enthusiasm at the hands of the employees, and Cricket, Bowls, and Football Sections are already working together with great zest and much success. A smoking concert was held on Monday, Nov. 14, at the Blue Gates Hotel, under the chairmanship of Mr. E. Hardiker, Engineer and Manager, supported by members of the Gas Committee and the Town Council. The Mayor, Alderman A. Morris, J.P., presented the Inter-Departmental Shield—the gift of the Gas Committee, to be competed for annually—to the winning team, which represented the works fitting shop. He also presented each member of the team with medals suitably inscribed. The evening was a great success in every respect, and augurs well for the future success of the Social Club. Great regret was expressed at the absence of the Chairman of the Gas Committee, Alderman C. W. Pinkney, J.P., owing to illness. In his absence, Alderman Williets, J.P., briefly addressed the gathering, and in the course of his encouraging remarks commented on the harmony and spirit of goodwill which prevails among the employees of the Gas Department.

The Audlem Gas Company have intimated that they propose to close down the gas-works in March, 1928.

The Bradford Corporation Gas Committee are considering an inquiry from the Bingley Urban District Council as to whether the Corporation would be prepared to enter into negotiations with a view to the sale to Bingley of the Wilsden portion of the Bradford gas undertaking, in view of Wilsden generally being essentially in the Bingley area rather than in the Bradford area.

Bradford's new Socialist Lord Mayor (Alderman Michael Conway) has determined on a policy of studying all classes of people at their work. He is arranging to visit various factories and works; and, starting with the Corporation's own departmental undertakings, he visited the Birkshall Gas-Works on Nov. 18. He was accompanied by the Chairman of the Gas Committee (Alderman Geo. Walker) and the Deputy Chairman (Councillor E. J. Cowie). At the works they were met by Mr. E. J. Sutcliffe, the City Gas Engineer and Manager; Mr. H. Akam, the Works Manager; and Mr. E. Crowther, Deputy Works Manager. The party made a complete survey of all phases of the work; and the Lord Mayor expressed his admiration of the manner in which one phase of work dovetailed into another.

CONTENTS.

EDITORIAL NOTES.

Reciprocal Interference—Parliament in Darkness . . . 593
Institute of Fuel and the President's Address . . . 594
Manchester Institution Address . . . 594
Gas-Heating Successes and Prospects . . . 595
Coal Selling Organizations . . . 596
Gasholder Accident at Manchester—Irritant to Prevent Suicide—Pittsburg Gasholder Disaster—"GAS SALESMAN" Supplement—Science and Industry—The Overmanned Coal Industry . . . 596
Trade Union Membership . . . 597

Forthcoming Engagements . . . 597
Personal . . . 597
Obituary . . . 597
The Evening Star Lodge, No. 1719 . . . 597
Electricity Supply Memoranda . . . 598
Institute of Fuel—
Presidential Address of Sir Alfred Mond . . . 599
Annual Dinner . . . 600
Gaseous Combustion at High Pressures. By Prof. W. A. Bone, D.Sc., F.R.S. . . . 601
Potential Investments. III.—The Sheffield Gas Company . . . 602
Gas and Air Mixture Control—Automatic System . . . 603
New Turbulent Burners . . . 603
Horton Spherical Gasholder. By W. S. Gray, B.A., M.A.I. (Dublin) . . . 604
Manchester District Institution of Gas Engineers—
Luncheon . . . 605
Business Meeting . . . 606
Presidential Address of Mr. C. S. Shapley . . . 606
City of Leeds Gas Department . . . 608
The Gasholder Disaster at Pittsburg . . . 610
Notes on Horizontal Settings: With Special Reference to Silica Retorts. By Stephen Hay . . . 612
Western Junior Gas Association—
The Control of Calorific Value. By J. Maisbury, B.Sc. . . . 617
A Method of Feed-Water Treatment. By J. Maisbury, B.Sc. . . . 618
Public Works, Roads, and Transport Congress—
Street Lighting Regarded as an Illumination Problem. By J. W. T. Walsh, M.A., D.Sc. . . . 619
Street Lighting of London. By W. J. Jones, M.Sc. . . . 620
Midland Junior Gas Association—
The Parkinson Stove Company's Stechford Works . . . 622
The Testing of Materials. By F. L. Atkin . . . 624
Lectures to Smoke Inspectors . . . 624

CORRESPONDENCE.

Test for Naphthalene in Coal Gas . . . 625
Welding Repairs to Gasholders . . . 625
Nuneaton Gas and a Two-Part Tariff . . . 625
Explosions . . . 625

REGISTER OF PATENTS.

Floor-Plate Fittings for Gas-Fires—Bromley, H. H., and Sheppard, M. . . . 626
Flue Nozzles for Gas Cookers—Oakley, P., Richardson, W. H., and Stoves, Ltd. . . . 626
Hopper Discharge Doors — Gas Light and Coke Company, and Leech, W. J. B., and Birks, F. M. . . . 626
Purifiers—Chrisp, G. . . . 626
Refractory Bodies—South Metropolitan Gas Company and Lamprey, R. H. B. . . . 626
Calorimeters—Simmance, J. F. . . . 627
Applications for Patents . . . 627

PARLIAMENTARY INTELLIGENCE.

House of Lords—
Progress of Bills . . . 627
House of Commons—
Progress of Bills . . . 627
Low-Temperature Carbonization . . . 627
Oil Fuel Extraction . . . 627
Bradford Road (Manchester) Gas Explosion . . . 627

PARLIAMENTARY INTELLIGENCE (*contd.*)—
House of Commons—
Smoke Abatement . . . 627
Gas Mantles . . . 627
Notices Given of Bills (Session 1928) Relating to Gas, &c., Undertakings . . . 627

LEGAL INTELLIGENCE.

Action Over the Working of a Small Tar Plant—McClellan *v.* Woodall-Duckham . . . 628

MISCELLANEOUS NEWS.

Gas Regulation Act Applications . . . 629
Institution of Chemical Engineers—Extract from the Report of the Board of Examiners . . . 629
Contracts Open . . . 629
Portsmouth Takes Over the Emsworth Company—Immediate Reduction in Price of Gas . . . 629
Oriental Gas Company, Ltd.—Annual General Meeting . . . 629
Trade Notes . . . 630
Current Sales of Gas Products . . . 630
Stock Market Report . . . 631
Coal Trade Reports—
North-East Coast . . . 632
Yorkshire and Lancashire . . . 632
Midlands . . . 632

PARAGRAPHS.

"S.B.G.I." Golf Circle . . . 597
Liquid Purification in Texas . . . 611
Danks-Pattison Gas-Fired Boilers . . . 616
A Vacuum Apparatus for Clearing Gas Pipes . . . 623
Frost Brings Big Business . . . 629
South Metropolitan Price Reduction—The Cost of a Gale—Burnley's New Gas-Works . . . 630
Hartlepool Gas and Water Stock Issue—Charges for Industrial Purposes at Rugeley—Bognor Gas and Electricity Company—Cooker Payment Periods—Lecture at Smethwick—New Gasholder for Barnstaple—Electric Lighting Failure—Yeadon Gas Exhibition—Proposed Extensions at Bradford . . . 632

For List of "JOURNAL" Advertisers, see p. 633.

— ONLY —

GENERAL

GAS COOKERS

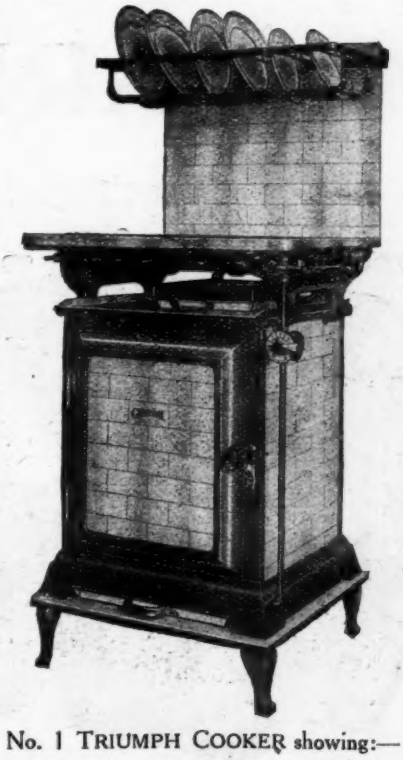
are fitted

WITH AN OVEN THERMOSTAT

Regulated

FROM THE FRONT

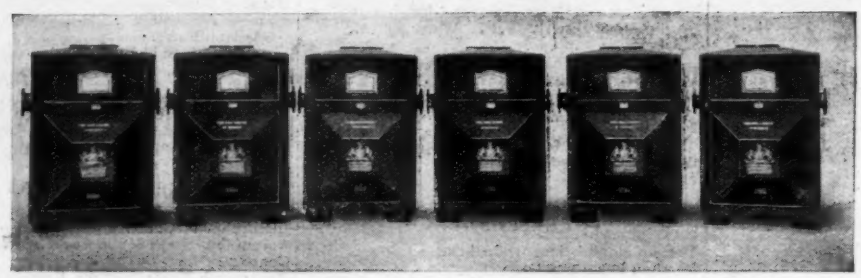
WORKS:—GUIDE BRIDGE, MANCHESTER



No. 1 TRIUMPH COOKER showing:—

ECONOMIC | AUTO-HEAT REGULATED

fitted in position.



METERS — Large & Small

With the 83 years' reputation for quality behind them. Unsurpassed for accuracy and durability. Manufactured throughout of finest materials by the most expert craftsmanship.

ORIGINAL DRY METER MAKERS
ESTABLISHED IN 1844

THOMAS GLOVER & CO. LTD.
GOTHIC WORKS, ANGEL RD. EDMONTON, N.18.

Branches at: BELFAST, BIRMINGHAM, BRISTOL, EDINBURGH, GLASGOW, MANCHESTER & NEWCASTLE-ON-TYNE

PARKINSON'S

PREPAYMENT METERS.

UNSURPASSED FOR QUALITY.

FITTED WITH LONG RANGE ATTACHMENT.

Outside Valve, Easily Accessible for Cleaning.

W. PARKINSON & CO.,

INCORPORATED IN PARKINSON & COWAN (GAS METERS), LTD.

COTTAGE LANE, CITY ROAD, LONDON, E.C.1.	BELL BARN ROAD, BIRMINGHAM.	MORNINGTON STREET ORMEAU ROAD, BELFAST.
Telegrams: "INDEX, ISLING, LONDON."	"GASMETERS, B'HAM."	"PREPAYMENT, BELFAST."
'Phone Nos.: 4710 Clerkenwell	2945 Midland, B'ham.	3874 Belfast.